U.S. Army Research Institute
for the Behavioral and Social Sciences

Research Report 1952

Measuring Noncommissioned Officer Knowledge and Experience to Enable Tailored Training

Peter S. Schaefer
U.S. Army Research Institute

Paul N. Blankenbeckler
Northrop Grumman Corporation

Christopher J. Brogdon
Mercer University
Consortium Research Fellows Program

November 2011

U.S. Army Research Institute
for the Behavioral and Social Sciences

Department of the Army
Deputy Chief of Staff, G1

Authorized and approved for distribution:

BARBARA A. BLACK, Ph.D.
Research Program Manager
Training and Leader Development Division

MICHELLE SAMS, Ph.D.
Director

Research accomplished under contract
for the Department of the Army

Northrop Grumman Corporation

Technical Review by

Seth A. Gitter, U.S. Army Research Institute
Jennifer Murphy, U.S. Army Research Institute

NOTICES

DISTRIBUTION: Primary distribution of this Research Report has been made by ARI. Please address correspondence concerning distribution of reports to: U.S. Army Research Institute for the Behavioral and Social Sciences, Attn: DAPE-ARI-ZXM, 2511 Jefferson Davis Highway, Arlington, Virginia 22202-3926.

FINAL DISPOSITION: This Research Report may be destroyed when it is no longer needed. Please do not return it to the U.S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The findings in this Research Report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy)	2. REPORT TYPE	3. DATES COVERED (from. . . to)
November 2011	Final	January 2010 to January 2011

4. TITLE AND SUBTITLE	5a. CONTRACT OR GRANT NUMBER
Measuring Noncommissioned Officer Knowledge and Experience to Enable Tailored Training	W74V8H-04-D-0045 DO#0041
	5b. PROGRAM ELEMENT NUMBER 633007

6. AUTHOR(S)	5c. PROJECT NUMBER
Peter S. Schaefer (U.S. Army Research Institute), Paul N. Blankenbeckler (Northrop Grumman Corp), Christopher J. Brogdon (Mercer University)	A792
	5d. TASK NUMBER 359
	5e. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)		8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army Research Institute for the Behavioral and Social Sciences ATTN: DAPE-ARI-IJ 6470 Way Avenue Ft. Benning GA 31995	Northrop Grumman Corp 3565 Macon Road Columbus, GA 31907	

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. MONITOR ACRONYM
U. S. Army Research Institute for the Behavioral & Social Sciences 2511 Jefferson Davis Highway Arlington, VA 22202-3926	ARI
	11. MONITOR REPORT NUMBER Research Report 1952

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

Contracting Officer's Representative and Subject Matter POC: Peter S. Schaefer.

14. ABSTRACT *(Maximum 200 words)*:

Tailoring training can improve effectiveness and efficiency. However, before informed decisions regarding tailoring Army institutional training can be made, instruments which predict performance must be available. To that end, instructors from the Infantry Advanced Leaders Course at Fort Benning, GA were interviewed to determine which course criteria exhibited large variation in student performance. Based on those interviews, two criteria were chosen: land navigation and troop leading procedures Four types of predictors were constructed for each criterion. The first type was predictive judgments of Soldier criterion performance. The second type was demographic items. The third type was self-report items concerning specific, criterion-relevant experiences. The fourth type was prior knowledge tests. For each criterion, prior knowledge alone significantly predicted performance. The different nature of the criteria has implications for both the construction of prior knowledge tests and how prior knowledge tests can be used to predict performance. Ways in which these results can be translated into user-friendly tools for course managers, instructors, and other relevant personnel are illustrated.

15. SUBJECT TERMS

prior knowledge, tailoring training, performance prediction, land navigation, troop leading procedures, Infantry ALC

SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON
16. REPORT	17. ABSTRACT	18. THIS PAGE			
Unclassified	Unclassified	Unclassified	Unlimited	71	Ellen Kinzer, Technical Publication Specialist 703.545.4225

Research Report 1952

Measuring Noncommissioned Officer Knowledge and Experience to Enable Tailored Training

Peter S. Schaefer
U.S. Army Research Institute

Paul N. Blankenbeckler
Northrop Grumman Corp

Christopher J. Brogdon
Mercer University
Consortium Research Fellows Program

ARI – Fort Benning Research Unit
Scott E. Graham, Chief

U.S. Army Research Institute for the Behavioral and Social Sciences
2511 Jefferson Davis Highway, Arlington, Virginia 22202-3926

November 2011

Army Project Number
633007A792

Personnel Performance and Training

ACKNOWLEDGMENT

The authors would like to express their gratitude to the leadership and staff of the Caro Noncommissioned Officer Academy at Fort Benning, Georgia for their time and feedback.

MEASURING NONCOMISSIONED OFFICER KNOWLEDGE AND EXPERIENCE TO ENABLE TAILORED TRAINING

EXECUTIVE SUMMARY

Research Requirement:

The operational tempo of the United States Army has increased dramatically, placing a premium upon effective and efficient training. However, what constitutes effective and/or efficient training varies from group to group and individual to individual. For decades researchers have explored the extent to which training quality can be improved by tailoring training, defined as assessing salient individual differences and assigning learners to learning conditions based on those differences. Criterion-relevant experience and prior knowledge are arguably the most robust predictors of performance, and are thus viable candidates as bases for tailoring training. However, before experience and prior knowledge can be used to make informed decisions about tailoring U.S. Army institutional training, effective and efficient measures of experience and prior knowledge must be developed and empirically validated.

Procedure:

Instructors from the Infantry Advanced Leaders Course (ALC) at Fort Benning, Georgia were interviewed to determine what course criteria exhibited large variability in student performance. Based on those interviews, two criteria were chosen: performance on a land navigation exercise and on a troop leading procedures (TLP) exam. For each criterion, four types of predictors were constructed. The first predictor type consisted of small group instructor (SGI) estimates of later land navigation and TLP performance. The second predictor type consisted of general biographic items which anecdotal evidence indicates instructors use to assess relevant experience. The third type asked questions related to criterion-relevant activities (e.g., familiarity with computer navigational systems, frequency of engagement in land navigation or use of troop leading procedures). The fourth type of predictor was a prior knowledge test. The instructors reviewed the instruments and recommended revisions. The final instruments were administered to an ALC class (N = 74).

Findings:

For both criteria, prior knowledge alone was a significant predictor. This finding questions the utility of relying upon general biographical information or self-report experience items to predict performance. Because the land navigation criterion consisted of a practical exercise vice the paper-and-pencil prior knowledge test, the predictive validity of the land navigation prior knowledge test was statistically significant but not large. However, using the seven most difficult prior knowledge items, we were able to predict successful performance on the land navigation criterion. Because the correlation between the TLP prior knowledge test and criterion was higher, we used both total prior knowledge scores and a subset of difficult prior knowledge items to predict TLP criterion performance.

Utilization and Dissemination of Findings:

The findings demonstrate the utility of prior knowledge measures for predicting performance and thus informing subsequent implementation of tailored training. These findings have been disseminated to Infantry ALC instructors at Fort Benning, GA and briefed to TRADOC personnel at Fort Eustis, VA.

MEASURING NONCOMISSIONED OFFICER KNOWLEDGE AND EXPERIENCE TO ENABLE TAILORED TRAINING

CONTENTS

Page

LIST OF TABLES

MEASURING NONCOMISSIONED OFFICER KNOWLEDGE AND EXPERIENCE TO ENABLE TAILORED TRAINING

Introduction

The operational tempo of the U.S. Army has increased dramatically in recent years. Soldiers are required to learn more in less time, and thereby need effective and efficient training. However, there is ample evidence both that learning related individual differences exist (Jensen, 1998; Thorndike, 1985) and that these individual differences interact with learning conditions (McNamara, Kintsch, Songer, & Kintsch, 1996). Thus, a given training method may be effective and efficient for one group but not for another group. For decades researchers have explored the extent to which training quality can be improved by tailoring training, defined as assessing salient individual differences and assigning learners to learning conditions based on those differences.

For tailored training to be effective, at least two conditions must be satisfied. First, there must be evidence demonstrating a significant relationship between one or more individual differences and performance. Second, there must be evidence of an interaction between one or more individual differences and the training condition (Pashler, McDaniel, Doug, & Bjorn, 2009). The goal of this report was to satisfy the first condition: to isolate individual differences which predicted criteria performance in a noncommissioned officer (NCO) course.

We chose to focus primarily on the individual difference of prior knowledge (defined as information, facts, and procedures required for successful performance in a domain—see Palumbo, Miller, Shalin, & Steel-Johnson, 2005). There are at least four reasons for doing this. First, previous research which based predictor selection on instructor identification of performance-relevant individual differences was not successful (Schaefer, Bencaz, Bush, & Price, 2010), suggesting a new approach was needed. Second, measuring prior knowledge is often an efficient means of capturing performance-relevant variance. Evidence indicates that general mental ability is the most robustly predictive of broad psychological constructs (Goska & Ackerman, 1996; Gottfredson, 1998; Jensen, 1998; Thorndike, 1985). However, general mental ability affects performance through the acquisition of prior knowledge. In addition, experience (often measured simply as self-reported length of time working in a given domain) also affects performance through the acquisition of prior knowledge. In other words, general mental ability plus experience within a domain contributes to prior knowledge, which in turn contributes to criterion performance. This means that general mental ability and experience significantly predict prior knowledge but not criterion performance. Prior knowledge, as the variable most directly related to criterion performance, *does* significantly predict criterion performance. Thus, measuring prior knowledge captures the joint effects of the two most powerful known predictors of performance (Borman, White, Pulakos, & Oppler, 1991; Borman, White, & Dorsey, 1995; Palumbo, Miller, Shalin, & Steel-Johnson, 2005; Schmidt & Hunter, 1993; Schmidt, Hunter, & Outerbridge, 1986). Third, the most replicated tailored training effects involve general mental ability and prior knowledge (Kalyuga, Ayres, Chandler, & Sweller, 2003; Snow, 1991, 1992). Fourth, we know that Soldiers sometimes vary in amount of prior knowledge (e.g., with digital systems; see Bink, Wampler, Goodwin, & Dyer, 2008).

However, we did not rely solely on measures of prior knowledge. We also constructed three other types of predictors. First, we asked small group instructors (SGIs) to predict the criterion performance of the Soldiers. Second, we had the Soldiers complete a demographic questionnaire containing general information items (e.g., military occupational specialty or MOS, deployment experience, etc.). Third, we constructed experience scales assessing various aspects of specific, criterion-related activities.

Our rationale behind the choice of these predictor types was as follows. First, it is of obvious interest to see how accurately small group instructors can predict Soldier performance, as presumably adjustments to instruction are based on such judgments. Further, research indicates that job supervisors appear to base their assessments of supervisee job performance more on prior knowledge than actual job performance (Schmidt, Hunter, & Outerbridge, 1986). In other words, supervisor perceptions of supervisee performance are more correlated with job knowledge than with actual job performance. Including instructor predictive judgments allows us to see if a similar pattern holds in a military course with SGIs. Second, anecdotal evidence indicates that many instructors rely upon informal cues like rank and deployment experience to make predictions about Soldier performance. Formally assessing the predictive power of such cues via the demographic questionnaire allows us to estimate the practical utility of such information. Third, constructing experience scales related to specific, criterion-related activities might be expected to yield more robust prediction than less targeted predictors like MOS or deployment. Finally, the demographic and experience scales were intended to address a difference between the occupational literature and Army institutional settings. In the occupational literature, experience is measured by simply asking individuals how long (e.g., months) they have been engaged in a specific domain (Schmidt & Hunter, 1993; Schmidt, Hunter, & Outerbridge, 1986). Given the different duty assignments performed by the U.S. Soldier, analogues of such simple measures (e.g., time in grade or time in service) were judged unlikely to significantly predict criterion performance.

Method

Course Selection

Our goal was to identify one noncommissioned officer (NCO) course and one officer course (Schaefer, Blankenbeckler, & Lipinski, 2011) with Soldiers who varied significantly in performance-relevant experience and knowledge. To guide our initial selection of courses, we developed seven criteria (Appendix A). We then began examining courses listed in the Army's Training Requirements and Resource System (ATRRS) to identify potential courses. At the same time, we developed interview protocols for use with course personnel. The protocols were designed to verify information obtained in ATRRS as well as gather information on course prerequisites, student demographics, and the nature of existing course performance criteria. Interviewing instructors from the potential course list as well as considering the availability of course personnel during the research timeframe resulted in the final selection of the Infantry Advanced Leaders Course (ALC) at Fort Benning, Georgia.

Description of Infantry ALC. The Infantry ALC is an NCO professional development course focused on training Infantry noncommissioned officers, primarily staff sergeants, for duty

as squad leaders. Interviews with course leaders, staff, and small group instructors (SGIs) indicated that Soldiers arrive at the course from diverse backgrounds and with widely varied experiences and knowledge. The Infantry ALC is a single gender, male only course.

There are two versions of the Infantry ALC: a mobile training team (MTT) version and a resident version. The MTT version involves a MTT training Soldiers at their home station. MTT courses are typically capped at 65 Soldiers located at the given home station. In comparison, the resident version of Infantry ALC is capped at 160 students and is open to Soldiers from across the Army, as opposed to Soldiers stationed at a given installation. Both sample size considerations and selection factors led us to the conclusion that the resident version would yield larger differences in relevant experience and knowledge. We therefore chose the 4.5 week-long resident version.

Selection of Performance Criteria

Our prior research focused on the relationship between broad cognitive traits (e.g., metacognition) and broad measures of achievement (e.g., overall course average—see Schaefer, Bencaz, Price, & Bush, 2010). However, using narrower criteria makes the construction of prior knowledge tests more tractable. We therefore asked instructors about narrower performance criteria which exhibited large performance differences. The instructors indicated that two such areas were land navigation and troop leading procedures (TLP).

Land navigation. Infantry NCOs are expected to arrive at Infantry ALC proficient in land navigation. However, instructors indicated that this expectation is not always met. Students are tested in a hands-on, live environment using a map and compass on a local navigation course. The test is administered in the first week of the course. Instructors indicated that no go (i.e., fail) rates are frequently high, and that this is in part because land navigation is often achieved by using Global Positioning System (GPS) devices rather than map and compass. The test consists of 8 terrain points which students must locate within three hours, and thus possible scores range from 0 to 8. A 'Go' is defined as locating 5 or more terrain points. The exercise is five hours long and begins two hours before dawn.

TLP. Instructors also indicated that many students arrive with only limited experience in preparing operations orders, operations overlays, or conducting TLP. All of these skills in various combinations are tested on the TLP test, which takes place approximately 2 weeks into the course. The TLP exam is a 30-item, multiple choice/fill-in-the-blank test assessing the skills of conducting reconnaissance, preparing an operational overlay, and conducting TLP. 'Go' status is achieved by correctly answering 70 percent or more (i.e., 21 or more) of the test items.

Participants

Participating in this research were 74 Infantry ALC Soldiers and 6 SGIs. All of the Infantry ALC solders were 11B infantry and all but one individual was a Staff Sergeant. Average time in grade in months (M = 20.57, SD = 10.10) and time in service (M = 88.56, SD = 30.37) was slightly less than two and slightly more than seven years, respectively.

All resident course SGIs were contractors and former NCOs with experience in instructing at least 2 iterations of the course. While there was a potential upper bound of 160 for this sample, inclement weather and attendant disruptions to plane travel reduced the number of available students. This had a large impact because the predictors were administered on the first day of the course.

Procedure

An initial group interview was held with the Infantry ALC instructors. We explained that our research goal was to target one or more performance criteria in the course which exhibited large differences in student performance. During the interview, instructors indicated their confidence that early in the course they could predict which students would and would not do well on the land navigation and TLP criteria.

After the criteria were chosen, we developed initial drafts of the predictor measures and submitted them to ALC instructors for review. In general, the feedback on the measures was positive, with the exception of some questions on the land navigation prior knowledge test. Instructors expressed concern that some of the items were very hard and suggested that the hard items be placed at the end of the test to prevent discouraging students from completing the measure. The instructors also suggested that we indicate that solving the difficult items did not require a map. Once these changes were made, all measures were approved.

The student measures were administered to the Infantry ALC class on the first day of class, and took between one and two hours to complete. Participating SGIs supplied their predictions of student criterion performance on the fourth day of class, and the land navigation exercise took place on the fifth day of class. The TLP exam took place on the ninth day of class. Notably, we were not permitted to examine the TLP criterion ahead of time, but were provided access to the tests and scores later. We were given access not only to the test summary scores but also the test items, and hence were able to verify that the skills tapped by the prior knowledge test and criterion exam overlapped. If we had been able to view the criterion beforehand and validate our selection and sampling of skills on the prior knowledge test, we might have been able to ensure greater skill overlap between predictor and criterion.

Measures

SGI predictions. SGIs were asked to predict how students would perform on the criteria. To make prediction tractable, we did not ask instructors to rank order the students from absolute highest to lowest. Instead, we asked them to indicate those students which they felt would fall into the bottom 25%, the middle 50%, or the top 25% of the criterion distributions (Appendix B). Instructors were first asked to predict the performance of students in their group, and were also given the further option of predicting the performance of other students (i.e., outside their group).

Demographic questionnaire and experience scales. Students first read a statement of informed consent and then completed a demographic questionnaire and various experience scales (see Appendix C for measures and response frequency information). Selection of demographic

items was guided by several considerations. For example, instructor interviews indicated that information such as Soldier MOS and deployment was used to predict student performance. In addition, our prior research has found that level of education can affect predictor-criterion relationships (Schaefer, Bencaz, Bush, & Price, 2010).

The rationale underlying the use of experience scales was as follows. Schmidt, Hunter, and Outerbridge (1986) found that a simple index of experience (e.g., total months/years) within a domain predicted prior knowledge. Given the fact that Soldiers may fill many duty positions during their service, it is difficult to construct such a direct, simple question regarding criterion-relevant experience. However, because asking questions related to time in grade and time in service require little effort, we included such items in the demographic questionnaire.

Nonetheless, just as prior knowledge is a more targeted and therefore more powerful predictor of criterion performance than general mental ability, perhaps asking targeted (i.e., specifically criterion-related) experience questions would also prove fruitful. We developed the experience scale questions by tapping infantry skills associated with land navigation and TLP. Only two of the experience questions (Questions 10 and 11) asked for simple yes/no responses.

All other experience scale items elicited self-assessments via one of two methods. First, the Soldiers were asked to self-report how often they had engaged in either land navigation (Questions 12 to 20) or TLP (Questions 23 to 29 and 30 to 32) activities. Second, the Soldiers were provided with brief tactical vignettes and asked to self-rate their land navigation (Questions 21 and 22) skills based on a series of graduated actions associated with the situation.

Prior knowledge tests. The prior knowledge tests (Appendices D and E) were designed to assess the standing of Soldiers with regard to skills which the course either presupposed they already possessed (as with land navigation) or built upon (as with TLP). An interplay of the following four factors drove the construction of both tests.

First, military subject matter expertise guided the construction of items judged to be easier and more difficult in the given domains (land navigation or TLP). Second, the tests did not rely upon the ability to recall or list facts and terms, but to use information and apply principles in the correct manner. This would also serve, presumably, to highlight differences in conceptual understanding which might not be brought out by simple recall. Third, the tests were designed to provide a measure of student knowledge without additional resources. For example, on the TLP prior knowledge test, images, maps, and a list of the TLP procedures were provided. Further, on the land navigation test questions were developed to avoid the need for a compass or protractor. This obviously aids in efficiency, as the tests become a stand-alone instrument. The real goal, however, was to see if Soldiers could rely on their conceptual understanding of what a compass or protractor helps them do and replicate that procedure mentally. This can be illustrated by highlighting the exchange in which instructors asked us to place those land navigation questions they perceived as harder at the end of the test and also asking us to make it clear that those questions *can* be solved without a map. Fourth, the questions on the tests were designed to prevent easy discrimination between correct and incorrect responses. This was accomplished by including common errors as options, or providing them with an item which did

not correspond to the options given in the question. (See Question 2 in Appendix D for an example of this.)

For the land navigation test in particular (Appendix D), sections of varied maps, overhead photographs, varied locations on the maps and photos, and ground-based photographic images were used to provide clear, unambiguous examples of terrain features, topographic map symbols, and comparisons of locations as the basis for questions. This required the Soldier to apply map-reading skills, not simply recall information broadly related to map-reading.

The questions were derived from a variety of skills required for night and day land navigation, both of which were tapped by the land navigation criterion practical exercise. Skills included plotting grid coordinates, knowing cardinal directions, understanding map features and colors, measuring distance, recognizing map scales, and using a compass at night. The intent was to evaluate knowledge that was directly applicable and necessary to successfully perform the practical exercise.

Questions also addressed advanced orienteering skills which required an understanding of standard military topographic map design and basic geometry above and beyond the Skill Level 1 land navigation and map reading skills tapped by the practical exercise. The intent was to identify Soldiers with map reading and land navigation skills surpassing the requirements of the practical exercise. The underlying assumption was that Soldiers who possessed more than basic skills would be quite likely to do well in the practical exercise.

Questions used varied locations and situations so that each question stood alone. Some questions were brief and relied on graphics, while others required development of a context and required more reading and comprehension. Creating each question as a stand-alone entity precluded the student from missing a subsequent question that built on a previous situation. This also avoided requiring that the questions be answered in a fixed sequence.

In discussing the land navigation prior knowledge test, it must be noted that the predictor was paper-and-pencil, yet the criterion was a hands-on practical exercise. Based on the research literature (Dubois & Shalin, 2005), we knew that the overall correlation between the predictor and criterion would likely be much lower than that for TLP. However, for several reasons we judged this a worthwhile line of inquiry. First, we were interested in establishing a quick and easily-administered predictor of performance. Second, there are costs associated with conducting field exercises. In the Infantry ALC, land navigation is not part of the formal program of instruction but included to address a perceived gap in training. Thus, Infantry ALC SGIs may be able to opt out certain students from formal assessment via the land navigation practical exercise. Third, there is little systematic examination of hands on (vice cognitive) tasks in the research literature.

For the TLP test (Appendix E), the questions assessed the use of TLP in planning/preparing for an operation, understanding a standard operations order, and interpretation of an operation's overlay using standard military graphics. The Soldier was provided with the steps of TLP and questions related to doctrinal uses of the process in planning and preparing for operations. For the operations order assessment, the Soldier was provided with the format for a standard five-

paragraph field order. The vignette and questions required the Soldier to organize the information received from higher headquarters into his own operations order as notes for issuing an oral order to his squad. For assessment of military graphics knowledge and skills, a diagram was provided supplemental to the photomap. Both provided friendly and enemy information and the overlays used standard military graphic symbols. Questions required the Soldier to identify symbols and interpret their meaning in context of the situation. For example, the Soldier was required to identify the location of specific threats to his unit and mission, as well as responsibilities within defined sectors and unit boundaries.

Section I of the test (questions 1 – 4) used a brief scenario to focus the NCO on a mission requiring preparation for offensive action. The intent was to have the student demonstrate an understanding of TLP in the context of how TLP would be applied and used by the squad leader in a typical duty position. The steps of TLP were provided and the student was required to demonstrate an understanding of the process. Multiple response questions were employed to provide insight to the student's understanding of aspects of TLP that were continuous or that could occur more than once in the process. The varied purposes and uses of a warning order (WARNO) were also the subject of a question.

Section II of the test (questions 5 – 13) placed the student in the role of a squad leader preparing for a mission. The squad leader was to prepare to brief his squad. This is a task that squad leaders would normally perform in the line of their duties. Details from the platoon leader's order and the format of a five-paragraph field order were provided, which is the information the squad leader would normally have available. The task was to organize the information to brief the order to the team leaders or squad. The students were required to make decisions about organizing the available information to facilitate the mission brief to the squad. Some latitude was provided for student responses.

Section III of the test (questions 14 – 20) focused on the student's ability to understand and interpret military symbols and graphics common to company and platoon operations overlays and digital system displays (e.g., Force XXI Battle Command Brigade and Below [FBCB2]). A photo map and scaled sketch of a battalion operation in an urban area sector were provided. This is typical information the squad leader would normally have available when performing his duties. Questions focused on understanding the symbols, the threat, and unit responsibilities in order to apply this information in performing as a squad leader.

Analysis Strategy

All analyses were conducted on SPSS 16.0 for Windows, and the alpha level for significance set at .05 for all tests. As this was an exploratory analysis, all *p* values should be treated with caution. We reported *p* values for the sake of completeness, but did not adjust for family wise error rate. Any confidence in the strength or pattern of the relationships should be tempered in the absence of replication. In analyzing the data, we used the following 3-stage strategy.

Data screening and scale construction. First, all predictor variables were examined for differential response rates (operationally defined as any question or item to which more than 80

percent of responses fell into a single category or assumed a single value), truncation of range, many response categories with few individuals, and other issues. If any such problems were found with an item, the item was dropped from further analysis and a rationale for the decision given. Second, all experience measure items were grouped into scales whenever possible. This was done by first examining the individual question descriptives. If no problems were found, then questions were grouped on the basis of common content and format. Cronbach's alphas were then computed to assess scale reliability. Unless removing an item resulted in an improvement in the scale's Cronbach's alpha by .10 or more (e.g., the scales Cronbach's alpha would increase from .80 to .90), all scales were left intact. Any potential scale items which exhibited no item-level statistical problems but which were insufficiently reliable when made into a scale were retained as stand-alone predictors. For example, say we had ten questions which displayed no statistical problems individual. However, only eight of the questions cohered into a consistent scale. Then the two 'excluded' questions would be retained as individual predictors in any further correlation and/or regression analyses.

Correlation and regression. In this second stage, all variables retained from the first stage were entered into a correlation matrix with the relevant criterion. Based on the Schmidt, Hunter, & Outerbridge (1986) findings, we had three expectations of the data. First, we expected that prior knowledge would significantly predict criterion performance, and that it would in fact be the strongest predictor. Second, we expected that one or more of the experience variables (time in grade, time in service, experience scales, and demographic variables) would significantly predict prior knowledge, but would not predict criterion performance. Third, we expected that the SGI predictions would significantly predict prior knowledge, but not criterion performance. These expectations, if met, would argue for using prior knowledge—not experience or proxies of experience like the included demographic items—to predict criterion performance. This is because, as noted in the introduction section, the Hunter, Schmidt, and Outerbridge (1986) findings indicate that experience is indirectly related to criterion performance. The experience-criterion relationship is therefore too weak to serve as the basis for making tailored training decisions.

If more than one significant predictor was found, both simultaneous and stepwise regressions were computed. Simultaneous regression gives an estimate of the upper limits of predictability, while stepwise regression estimates the utility of using only a subset of predictors. This is useful information, as combining information from multiple predictors is easy when using statistical software but might be burdensome for the envisioned 'end user' who is unlikely to have access to such software. A more sensible procedure might be for the end user to focus on two (or, better, one) robust predictor of criterion performance.

Predicted versus observed performance categories. This third and final stage focused on illustrating how different predictors, with different performance criteria (i.e., hands-on land navigation practical exercise vice paper-and-pencil TLP exam) could be translated into 'user friendly' information for use by course instructors, managers, and other relevant personnel. We approached this problem in the following way.

We followed Cohen's (1992) proposed lower boundary for a large effect size as a correlation of .37 or larger. If such a correlation was found, we then subjected the variables to

both Steps 1 and 2 (outlined below). If such a correlation was not found, we skipped Step 1 and proceeded to Step 2.

Step 1: Total score relationships. For these procedures, we visually scanned the predictor and criterion total score frequency distributions to see if naturally occurring break points were present. To foreshadow our results, we found that the TLP predictor and criterion distributions both suggested a break into thirds. (Obviously, different break points might be constructed on the basis of instructor judgment. For example, an instructor might be interested in the top and bottom 10 percent.) We then examined the relationship between the predictor and criterion thirds by constructing crosstabs indicating the number of Soldiers who were correctly (and incorrectly) classified on the basis of their standing on the predictor variable. We then repeated the crosstab procedure, but this time compared the relationship between predictor thirds and Go/No Go status on the criterion. This allows for the comparison of predictor standing with a criterion that would be readily familiar to instructors.

Step 2: Subsets of easy and hard prior knowledge items. For all predictor/criterion pairs we attempted to isolate subsets of the easiest and hardest prior knowledge items and assessed their relationship to total criterion scores. First, crosstabs between the easiest and hardest prior knowledge items and criterion scores were created to see if interpretable patterns emerged. Second, crosstabs were created to see if there was any evidence of an interpretable relationship between easy/hard item performance and Go/No Go status on the criterion.

As discussed earlier, our rationale for this approach was that individuals who fared poorly on the easy prior knowledge items would likely fare poorly on the land navigation criterion, and individuals who fared well on the hard prior knowledge items would fare well on the criterion. Such 'mini tests' might save course personnel the time of scoring the full test (although, as we explain later, there might be reasons to administer the complete prior knowledge test).

Results

To improve readability, a minimum of statistics is cited in the text. In the case of more complex response patterns, a verbal summary is provided. When the phrase 'most respondents' is used, this means that more than 80% of Soldiers gave the same response, and that the item was dropped from further analysis. (See Appendix F for descriptive statistics of the retained variables.)

Data Screening and Scale Constructions

All variables were examined both descriptively and graphically. When a decision was made to exclude a variable from further analysis, a reason for that exclusion was given. Variables were examined in the order in which they appeared in the Appendices and in which they were described above (e.g., SGI predictions, demographic questions, experience scales, prior knowledge tests, and performance criteria). When we reported criterion statistics, we did so both for total points and percent correct.

SGI predictions. Although most SGIs indicated during the interviews their belief that they can intuitively assess current experience and knowledge as well as predict future performance, many were reluctant to make formal assessments when requested. Further, despite initial confidence that accurate intuitive prediction was possible early on, instructors felt that they did not have sufficient time with the students to form an accurate opinion. The result for both criteria was that fewer than 50% of all Soldiers had SGI predictions. Therefore, this variable was dropped from further analysis. This also means that the three 'expectations' of the data were reduced to two.

Demographic questionnaire. All items in the demographic questionnaire were examined for problems. As stated above, decisions to exclude variables from subsequent analyses are clearly stated and defended. Because many of the demographic variables were dropped in this stage of analysis, we grouped the variables into 'dropped' and 'retained'.

Dropped variables. There were two factors which caused demographic items to be dropped from further analysis. Most respondents answered the rank, military occupational specialty (MOS), and service status questions the same way, so these variables were dropped. The second factor was too many response categories with too few responses in each category. This led to the exclusion of questions asking year of Warrior Leader Course (WLC) or Primary Noncommissioned Officer Course (PNCOC) completion as well as the deployment questions, replicating a pattern seen in our earlier research (Schaefer, Bencaz, Price, & Bush, 2010).

It is worth noting that this does not preclude this information being correctly perceived as useful by instructors. For example, prior iterations of the course could have broken along cleaner lines with, say, half of the class having a specific deployment experience and the other half not. Such a pattern would lend itself both to instructor perception and statistical analysis of predictor/criterion relationships. However, the data we do have (combined with prior research, as noted above) does not engender confidence in using such items to make tailored training decisions.

Retained variables. The retained demographic variables were time in grade, time in service, and civilian education levels. Although the time in grade and service questions were posed in terms of years and months, for ease of computation we translated both of these variables into total months. Responses to the civilian education level ranged from GED to Bachelor's degree, with most responses falling into the 'high school diploma' or 'some college' options. As there were so few individuals with college degrees, however, the follow-on question asking for the specific field of study (e.g., Business, Computer Science) was dropped.

Experience scales.

Land navigation. The first potential experience scale for land navigation involved Questions 10a, 10b, 10c, and 11. All asked if students had experience with digital systems for navigational support and operations/situation awareness support. Unfortunately, most respondents answered Questions 10a, 10b, and 11 the same way, so these variables were dropped. This left Question 10c on use of maps and compass as primary navigation aids as a predictor. (See Appendix D for the specific questions.)

The second potential experience scale for land navigation involved Questions 12 through 20, which asked students to estimate how frequently they had engaged in land navigation related behaviors. Possible responses ranged from "never" to "daily." Descriptive analyses of these questions revealed no item-level problems, and Cronbach's alpha was .92. This scale (henceforth the Land Navigation Frequency, or LNF, Scale) was retained.

The third potential experience scale for land navigation involved Questions 21 and 22, which placed students in a vignette. Both of the questions exhibited no statistical problems, but displayed an unacceptably low Cronbach's alpha of .24 when combined into a scale. Therefore, this scale was not retained, but both questions were retained as individual predictors.

TLP. The first potential TLP experience scale involved Questions 23 through 29, which asked students to estimate how frequently they engaged in TLP related behaviors. Descriptive analysis of the questions revealed no item-level problems, and Cronbach's alpha was .89. This scale (henceforth the TLP Frequency, or TLPF, Scale) was retained.

The second potential TLP experience scale involved Questions 30 through 32, which asked students frequency questions in a slightly different format than the TLPF scale. Descriptive analysis of the questions revealed no item-level problems, and Cronbach's alpha was .73. This scale (henceforth the TLP Frequency 2, or TLPF2, Scale) was retained.

Prior knowledge tests.

Land navigation prior knowledge test. Descriptive analysis of the questions revealed no item-level problems, and Cronbach's alpha was .58. This relatively low alpha is in part due to the nature of its intended use. Namely, we deliberately included very easy and very hard items. We expected that many people would be able to successfully complete the easy items but have trouble with the hard ones, thereby reducing internal measures of reliability. This test was retained.

TLP prior knowledge test. Descriptive analysis of the questions revealed no item-level problems, and Cronbach's alpha was .81. More detailed analyses indicated that the overall alpha would not be improved by removing any items. This test was retained.

Performance criteria.

Land navigation. No item-level analysis was appropriate as this was a hands-on practical exercise and summary scores only (0 to 8 points) were provided. Although instructor interviews indicated that the 'No Go' rate in previous course iterations had been as high as 50%, the rate in the sample was much lower (13.4%).

TLP. Descriptive analysis of the items revealed no problems, and the Cronbach's alpha was .66. More detailed analyses indicated that the overall alpha would not be improved by removing any items.

Correlation and Regression

The three demographic variables common to both criteria analyses were time in grade, time in service, and level of civilian education. There were six total variables (five predictors and the criterion) correlated in the land navigation analysis, and seven in the TLP analysis.

Land navigation. The predictor variables were time in grade, time in service, civilian education level, the LNF Scale, and the land navigation prior knowledge test (see Table 1.) Now we turn to what we expected the data to show. Our first expectation was met. Prior knowledge did significantly predict criterion performance ($N = 67$, $r = .28$, $p < .05$), and was the strongest (in fact, the only significant) predictor. As expected given the different natures of the predictor and criterion, the correlation was of small magnitude. However, our second expectation was not met. We had anticipated that one or more of the experience variables would be significantly correlated with prior knowledge, but not with the criterion. In fact, neither prior knowledge nor the criterion was predicted by any of the experience variables. As noted above, we were unable to assess our third expectation as so few SGI predictions were supplied.

Table 1
Land Navigation Correlations

	1	2	3	4	5	6	7	8	9
1	--	-.22	-.19	-.07	-.01	.17	.12	.18	.28*
2		--	.58*	.03	.12	.06	.01	-.04	-.22
3			--	.12	.04	.17	-.22	-.14	-.13
4				--	-.15	-.01	-.27*	-.04	.13
5					--	-.29*	-.03	-.32*	.12
6						--	.14	.28*	.24
7							--	.25*	.05
8								--	.08

Note: *=correlations $p < .05$.
*N*s ranged from 60 to 74.
1=Land Navigation Criterion
2=Time in grade
3=Time in service
4=Civilian Education Level
5=Question 10c
6=Question 21
7=Question 22
8= LNF Scale
9= Land Navigation Prior Knowledge

TLP. The variables in this analysis were time in grade, time in service, civilian education level, the TLPF and TLPF2 scales, the TLP prior knowledge test, and the TLP criterion (see Table 2). We again assess our two expectations. Our first expectation was met. Prior knowledge did significantly predict criterion performance (N=74, r = .40, p < .01), and it was the strongest (again, the only significant) predictor. However, our second expectation was not met. We had expected that one or more of the experience variables would be significantly correlated with the predictor, but not the criterion. As with the land navigation data, neither prior knowledge nor the criterion was predicted by any of the experience variables. As noted above, we were unable to assess our third expectation as so few SGI predictions were supplied.

Table 2
TLP Correlations

	1	2	3	4	5	6	7
1	--	-.12	-.02	.18	-.07	-.09	.40*
2		--	.58*	.03	.19	-.08	-.06
3			--	.12	-.03	-.12	-.12
4				--	-.02	-.18	.08
5					--	.43*	-.04
6						--	-.10

Note: *=correlations p <.05.
*N*s ranged from 71 to 74.
1=TLP Criterion
2=Time in grade
3=Time in service
4=Civilian Education Level
5=TLPF Scale
6=TLPF2 Scale
7=TLP Prior Knowledge

The correlation between prior knowledge and criterion performance found here is lower than that observed in other research examining prior knowledge/criterion relationships. In part, this is probably due to the different nature of the measures. Other research tends to use very lengthy measures of prior knowledge consisting of more than a hundred items. In addition, it is traditional psychometric practice to generate a large bank of test items and empirically validate them, removing the less predictive ones as validation proceeds. We did not have that luxury.

There is also another consideration. As noted above, we were not given access to the criterion measure until after we had developed the TLP prior knowledge test and the TLP exam had been administered. We were therefore unable to verify the specific skills being assessed in the criterion measure, the nature of the criterion questions (e.g., largely recall vice more analytically demanding questions), or the number of items drawn from a specific skill. To make this point clear, in Table 3 below we provide a crosswalk of the skills tapped by the TLP prior knowledge test and TLP exam.

Table 3 illustrates the pitfalls involved in having to construct a prior knowledge measure without having access to the criterion. First, the skills sampled on the prior knowledge test and the criterion exam do not overlap as much as they could. Consider the last four skills listed in the table. There are a total of ten items on the prior knowledge test which do tap those skills, and none on the criterion measure which do so. Second, the nature of the questions differed as well.

While the questions on the prior knowledge test were more analytical in nature, several questions on the exam were more recall based. Third, even when skills were tapped by both measures, there were differing degrees of emphasis. Consider the skill "Conduct Troop Leading Procedures". There were four items on the prior knowledge test which tapped that skill, and sixteen on the exam.

Table 3
TLP Prior Knowledge and Criterion Skill Crosswalk

Task	Task Number	Type Task	Skill Level	Prior Knowledge Items	TLP Criterion
Use a map overlay	071-329-1019	Common	2	14 – 17, 18 - 20	17, 22 – 23, 30
Issue a Warning Order (WARNO)	071-326-5503	Common	2	3 - 4	9, 26
Conduct a Leader's Reconnaissance	071-410-0010	11B	3	3	4, 9, 12, 16, 22, 24, 27
Prepare an Operation Overlay	071-332-5000	Common	3	14 - 20	3, 17, 22 – 23, 30
Prepare a Situation Map	071-332-5021	Common	3	14 - 20	4 – 5, 17, 22, 23, 30
Prepare an oral Operation Order	071-326-5626	11B	4	1, 5 - 13	1 – 5, 7 – 14, 19, 24, 26
Integrate threat capabilities into mission planning	159-200-2020	Common	4	18, 19	5, 6
Conduct Troop Leading Procedures	07-3-5036	Collective	Sqd/Plt	1 - 4	1 – 5, 7 – 10, 12 – 14, 16, 19, 24, 26, 27, 29
Conduct a rehearsal	07-3-5000	Collective	Sqd/Plt	2	9
Prepare for combat	07-3-5081	Collective	Sqd/Plt	2	9, 13
Establish an observation post	07-3-2018	Collective	Sqd/Plt		22, 29
Assault a building	07-3-1000	Collective	Sqd/Plt	14 - 20	
Take action on contact	07-3-1432	Collective	Sqd/Plt	11	
Treat and evacuate casualties	07-3-4045	Collective	Sqd/Plt	6	
Conduct a passage of lines as the passing unit	07-3-1099	Collective	Sqd/Plt	15	

Predicted Versus Observed Performance Categories

Land navigation. As the total score correlation did not meet or exceed the .37 value, we proceeded to the use of easy and hard prior knowledge items. First, we calculated the number of

correct responses to each prior knowledge item (Table 4). We then calculated performance on the 5 easiest questions (Questions 12, 4, 5, 13, and 14) and examined the relationship between that variable and criterion performance. The resulting display revealed no interpretable pattern. We therefore added the next easiest items (Questions 2b and 16) and repeated the crosstab procedure. Again, there was no interpretable pattern. Thus, poor performance on the easiest questions was not diagnostic of criterion performance. This may be due to the fact that the failure rate for our sample was much lower (13.4%) than reported for earlier iterations.

Table 4
Land Navigation Prior Knowledge Item Difficulties

Question Number	% Correct Responses	Question Number (Cont.)	% Correct Responses (Cont.)
12	89.6	2a	44.8
4	83.6	9	41.8
5	76.1	8	35.8
13	73.1	7	23.9
14	71.6	19	19.4
2b	68.7	20	14.9
16	67.2	15	14.9
3	65.7	11	11.9
1	64.2	6	7.5
10	56.7	2d	7.5
2c	53.7	18	3
17	44.8		

We therefore turned our attention to the hardest prior knowledge items. We focused on the six hardest items (Questions 18, 2d, 6, 11, 15, and 20) rather than five, as two of the items (Questions 15 and 20) were equally difficult. We then tabulated the results. An interpretable pattern began to emerge, albeit with some categorization error. We therefore added the next hardest prior knowledge item (Question 19).

Most individuals who answered two or more of those hard items correctly scored 5 or more points on the land navigation criterion (and thus achieved a ‘go’ status). Increasing the subset of items to the seven hardest items (Questions 18, 2d, 6, 11, 15, 20, and 19) further clarified the pattern (see Table 5). We therefore succeeded in selecting a subset of prior knowledge items which predicted successful criterion performance.

Notice that scoring poorly on the seven questions does not aid in predicting unsuccessful performance on the land navigation criterion. In fact, the majority of those who fail the hard items (44 out of 53) still successfully completed the criterion exercise. However, all who scored well on the hard items (N=14) achieved “Go” status. Another way of stating this is that *successful* performance on the hard prior knowledge items was diagnostic, while unsuccessful performance was not.

Table 5
Hard Land Navigation Prior Knowledge Items vs. Criterion Go/No Go

	Land Navigation Criterion		
Land Navigation Prior Knowledge Test: 7 Hardest Items	No Go	Go	Row Totals
0-1 Items Correct	9	44	53
2 or More Items Correct	0	14	14
Column Totals	9	58	67

Note. Entries in cells equal number of students who fell into that category.

TLP. As the correlation between the total predictor and criterion scores exceeded the .37 threshold, we examined the ability of both total prior knowledge score as well as easy/hard prior knowledge items to predict total criterion score performance. We first examined both the TLP prior knowledge and criterion distributions and found that both variables could be broken into thirds without unduly distorting the distributions (Table 6).

Table 6
TLP Prior Knowledge and Criterion Performance Categories by Thirds

TLP Prior Knowledge Scores			TLP Criterion Scores		
Points	Cumulative Percent of Soldiers	Performance Category (Thirds)	Point Range	Cumulative Percent of Soldiers	Performance Category (Thirds)
6-17	35.1	Bottom	15-23	30.6	Bottom
18-23	63.5	Middle	24-26	66.7	Middle
24-32	100	Top	27-30	100	Top

If the goal was to be as mathematically precise as possible, we would be referring extensively to predicted criterion scores. But the goal here is to provide end users with usable information derived from regression procedures. Therefore, it seemed best to provide range information like that displayed in Table 6. For example, if there was a "perfect" relationship between prior knowledge and the criterion, then if an individual scored between 18 and 23 on the prior knowledge test, they would be expected to score between 24 and 26 points on the criterion. However, typically you don't have a perfect correlation and therefore need to supplement such information with a table that contains measurement error information (Table 7). Obviously, stronger correlations between the two distributions should result in less categorization error in the resulting table.

Table 7
TLP Prior Knowledge and Criterion Performance Categories by Thirds

Prior Knowledge Scores	**Actual Criterion Category**			**Row Totals**
Thirds	Bottom (15-23 pts)	Middle (24-26 pts)	Top (27-30 pts)	
Bottom (6-17 pts)	14	7	**5**	26
Middle (18-23 pts)	4	8	7	19
Top (24-32 pts)	**4**	11	12	27
Column Totals:	22	26	24	72

Note. Entries in cells equal number of students who fell into that category. Underlined entries indicate correct classifications. Bolded entries indicate extreme classification errors.

One way of understanding the information shown in this table is to look at the bolded entries, which represent 'extreme' categorization errors. For example, of the 26 Soldiers who scored in the bottom third of the prior knowledge distribution, only 5 scored in the top third of the criterion distribution. Conversely, of the 27 Soldiers who scored in the top third of the prior knowledge distribution, only 4 scored in the bottom third of the criterion distribution.

We next explored the relationship between the thirds of the prior knowledge distribution and 'Go' status on the criterion (Table 8). 'Go' status is defined by course personnel as 70 percent or more items answered correctly. In this case, the pattern is much clearer than in Table 7. Individuals who scored in the top two thirds of the prior knowledge test, almost without exception, achieved 'Go' status on the criterion.

Table 8
TLP Prior Knowledge Performance Categories and Criterion Go/No Go

Prior Knowledge Scores	**Criterion Status**		**Row Totals**
Thirds:	No Go	Go	
Bottom (6-17 pts)	8	18	26
Middle (18-23 pts)	1	18	19
Top (24-32 pts)	1	26	27
Column Totals:	10	62	72

Note. Entries in cells equal number of students who fell into that category.

We then turned to an analysis of the relationships between the easiest/hardest prior knowledge items and overall TLP criterion score. As we discussed this procedure in detail in the land navigation section, we proceed with minimal comment to its TLP application. Utilizing item difficulty information, we tabulated performance on the five easiest items (Questions 2, 3, 9, 18a, 4d, and 1—see Table 9) against total criterion performance. However, no significant relationship emerged, and subsequent additions of the next 2 easiest questions proved equally fruitless. We therefore turned our attention to the hardest prior knowledge items.

Table 9
TLP Prior Knowledge Item Difficulties

Question Number	% Correct Responses	Question Number (Cont.)	% Correct Responses (Cont.)
2	91.9	18e	63.5
3e	89.2	4b	56.8
9	87.8	4c	56.8
18a	86.5	16	56.8
4d	82.4	18f	56.8
1	81.1	10	55.4
17	79.7	4e	54.1
5	78.4	19	51.4
3d	74.3	8	47.3
4a	74.3	6	45.9
18g	70.3	20	45.9
15	68.9	7	43.2
14	67.2	3c	40.5
12	66.2	11	33.8
18b	66.2	3a	32.4
18c	63.5	13	17.6
18d	63.5	3b	17.6

First we tabulated the relationship between performance on the five hardest prior knowledge items (Questions 3b, 13, 3a, 11, and 3c) and total criterion performance. It was evident that a predictive relationship had emerged. Correctly answering four or more out of the five hardest items correlated with scoring between 26 and 30 points on the TLP criterion. We therefore divided the criterion distribution into 0-25 and 26-30 points and the hard items into 0-3 correct and 4 or more correct (see Table 10). We also mapped the 0-3 versus 4 or more correct onto 'Go' criterion status (see Table 11). Those individuals (*N*=5) who got 4 or more of the hard items correct achieved 'Go' criterion status. Once again, successful performance on the hard items was more diagnostic than failure on those items.

Table 10
Hard TLP Prior Knowledge Items vs. Criterion Performance Categories

	TLP Criterion		
TLP Prior Knowledge Test: 5 Hardest Items	0-25 points	26-30 points	Row Totals
0-3 Items Correct	38	29	67
4 or More Items Correct	0	5	5
Column Totals	38	34	72

Note. Entries in cells equal number of students who fell into that category.

Table 11
Hard TLP Prior Knowledge Items vs. Criterion Go /No Go

	TLP Criterion		
TLP Prior Knowledge Test: 5 Hardest Items	No Go	Go	Row Totals
0-3 Items Correct	10	57	67
4 or More Items Correct	0	5	5
Column Totals	10	62	72

Note. Entries in cells equal number of students who fell into that category

Discussion

Before proceeding to our recommendations for constructing criterion performance predictors, we judged it helpful to summarize our findings by repeating how our expectations of the data conformed to reality. For both criteria, our first expectation was supported. Prior knowledge significantly predicted criterion performance. For both criteria, our second expectation was not supported. We expected that one or more of the experience variables would significantly predict prior knowledge but not criterion performance. In fact, none of the experience variables predicted either prior knowledge or criterion performance. Our third expectation was that the SGI ratings would significantly predict prior knowledge but not criterion performance. However, despite initial confidence in their ability to predict Soldier criterion performance, instructors often declined to quantify their predictive assessments.

It is interesting that the experience variables which were arguably the least related to prior knowledge and criterion performance were time in grade and time in service, as these are the closest analogues to how experience is measured in the research literature. Plausibly, this underscores our point that Soldiers fill many duties and thus these two time variables may reflect experience in conducting many different tasks, not just ones related to the course criteria.

We were surprised, however, that there the experience scales did not significantly predict prior knowledge, despite being intercorrelated with each other. One possible explanation for this lack of relationships is as follows. The experience scales asked individuals to reflect on how frequently they had engaged in either land navigation or TLP activities during intense periods of activity. It did not ask individuals to identify how long ago those intense periods of activity occurred. Therefore, it could either have occurred so long ago that the frequency judgments are marred by misremembering or, alternatively, the frequency judgments are largely correct but the knowledge gained from those activities has simply faded in the intervening time period. While these suppositions seem plausible they must, of course, remain speculative given the correlative nature of our data.

In sum, the relationships between experience, prior knowledge, and criterion performance from other research (Borman, White, Pulakos, & Oppler, 1991; Borman, White, & Dorsey, 1995; Palumbo, Miller, Shalin, & Steel-Johnson, 2005; Schmidt & Hunter, 1993; Schmidt, Hunter, & Outerbridge, 1986) were only partially replicated here. Prior knowledge was indeed the

strongest (in fact, the only) predictor of criterion performance. However, the failure of the experience variables to predict prior knowledge underscores some of the differences between the contexts of Army institutional training and research settings.

Also relatively consistent across the two analyses were the results of using easy and hard prior knowledge items to predict criterion performance. For both of the criteria, predicting poor performance using easy prior knowledge items was unsuccessful. Conversely, using hard prior knowledge items resulted in identifying a small set of Soldiers who almost without fail performed successfully on the criteria. Again, we note that it was *successful* performance on the hard prior knowledge items which was diagnostic. Predicting poor criterion performance required using the total score from the TLP prior knowledge test.

Recommendations

In the absence of replication, our findings should be accepted provisionally. However, the fact that the findings were consistent across the two analyses does lend credence to our results. We are therefore confident in the following recommendations based upon these data.

Use Prior Knowledge as a Predictor

When possible, using prior knowledge as a predictor is a good bet. As discussed in the introduction of this paper, prior knowledge captures the joint effects of both mental ability and experience within a domain. This was borne out by the fact that in both of our analyses, prior knowledge alone significantly predicted performance.

Combine Prior Knowledge With Narrowly Focused Demographic Variables

The general sorts of demographic variables which anecdotal evidence suggests instructors use to assess current and future performance were not predictive. However, it seems to us that using demographic variables to ferret out subgroup differences is a promising avenue. Although the instructors indicated no awareness of broad subgroup differences in the ALC population, our prior (Schaefer, Bencaz, Bush, & Price, 2010) and current (Schaefer, Blankenbeckler, & Lipinski, 2011) research has found at least two Army courses in which subgroup differences (as measured by demographic variables) exhibited starkly different predictor-criterion relationships. Encouragingly, in both of those courses the subgroup populations were brought to our attention by the course instructors, indicating that such differences are sometimes known to course personnel.

Estimate Total Score and Easy/Hard Item Relationships When Validating Predictors

If the correlation between prior knowledge and criterion total score is large enough (using our given rule, .37 or more) then crosstabs can be used to generate information usable by course personnel. Such information can then be leveraged to probabilistically categorize future criterion performance throughout the entire examined criterion range. Further information can be gleaned by examining the ability of hard (and, in theory, easy) prior knowledge items to predict criterion performance.

When no large (.37 or greater) total prior knowledge-criterion score correlation is present, it is still possible to use sets of hard items to predict who will do extremely well. However, as the TLP data demonstrated, even when a strong correlation *is* present, using subsets of hard prior knowledge items can be helpful. We are less sure how feasible it is to use sets of easy items to predict who will not do very well. This is probably a function of the different difficulty levels of the prior knowledge test, the criterion test, and a variety of other factors. In any case, we were unable to accomplish this in the current effort.

It is probably also prudent to administer the complete exam rather than just the subsets of easy and hard items. In the case of the TLP prior knowledge test, for example, some of the questions build upon earlier ones and are placed in a given context. Having students answer just some of the questions would require revising the test, and thus calling into question all of the psychometric test information we reported here. In the case of the land navigation exercise, administering the hard items alone would likely demotivate individuals who were daunted by the skill level required. Having those individuals complete a prior set of questions which they could answer might counteract this. This does not require, of course, that the instructor grade the entire measure. Rather, the instructor could administer the entire instrument and focus on only the hard items when grading.

Explore the Predictor-Criterion Relationship in Multiple Ways

The previous paragraph dovetails with the following contention: just because one metric (e.g., a correlation) indicates a weak relationship between a predictor and a criterion does not mean that another method (here, hard prior knowledge items) will not reveal a more useful relationship. In addition, exploring the relationships between performance on hard predictor items and overall criterion performance was very illuminating. It is perfectly possible that viewing the data through a specific lens-say, how hard item performance relates to 'Go' status on a criterion—can fail to reveal a relationship which would be readily seen if explored in other ways.

Greater efficiency appears to be obtained when the design of predictor items is focused on the actual criterion. While predictor items focused on specific tasks, knowledge, or skills have some value, that value seems to increase when assessment methods parallel or coincide with assessment techniques used in the criterion. When this paralleling of structures is not possible the questions should be designed to not merely focus on simple recall or the ability to list facts and terms, but should require the use of information and application of principles in the correct manner. This design provides improved insights to differences in conceptual understanding not brought out by simple recall.

When Possible, Use Hands-on Predictors with Hands-on Criteria

In this effort, we judged the potential savings in time gained by using a paper and pencil predictor for a hands-on practical land navigation exercise worth the effort. However, not all hands-on criteria require such investment in time and effort. For example, if the hands-on

criterion can be performed on readily available equipment, it is sensible to have Soldiers demonstrate directly on the equipment rather than rely on a paper and pencil measure.

Develop a Big Set of Predictor Test Items for Initial Exploration

We did not have the luxury of developing a big set of predictor items, although this is standard practice in large scale psychometric efforts. This allows for greater flexibility in including items which range from very easy to very hard. In turn, this would perhaps allow for more refined use of easy and hard items.

Focus on Narrow Criteria

In our prior research (Schaefer, Bencaz, Bush, & Price, 2010), we focused on broad psychological traits (e.g., metacognition) and broad measures of achievement (e.g., class average). However, given the relative success of using prior knowledge measures as predictors, a different tact is advisable.

Constructing prior knowledge measures which would tap the content of an entire course seems ill-advised. First, developing and administering such a measure would take an inordinate amount of time. Second, it is unclear how helpful such information would be. If the person does poorly on all aspects of the measure, do you have to tailor the entire course around them? Third, such an approach does not lend itself to assessment throughout a course.

It seems more feasible to make 'mini-tests' available to instructors prior to blocks of instruction or training of tasks that are important in terms of money, core objectives, establishing foundational knowledge and skills, or just plain difficult. Then decisions can be made regarding what kind of tailoring (if any) is warranted on that particular block of training.

In sum, making intelligent tailored training decisions will require a unique blend of testing and subject matter expertise. The need for testing expertise is obvious, requiring knowledge of test construction and validation procedures. However, the need for subject matter expertise is at least as (if not more) important. Subject matter experts will be required to help test creators determine suitable items for tapping prerequisite skills and experiences. In addition, subject matter experts can help test creators determine what kinds of demographics should be included to test for subpopulation differences. The two subpopulation differences found in our prior (Schaefer, Bencaz, Bush, & Price, 2010) and current (Schaefer, Blankenbeckler, & Lipinski, 2011) research were brought to our attention by course personnel prior to test construction. Developing research teams with the appropriate psychometric and military expertise will require careful investment of resources, further suggesting the need for targeting areas in which tailoring will yield the most benefit.

References

Bink, M. L., Wampler, R. L., Goodwin, G. A., & Dyer, J. D. (2009). *Combat veterans' use of Force XXI Battle Command Brigade and Below (FBCB2).* (Research Report 1888). Arlington, VA: U. S. Army Research Institute for the Behavioral and Social Sciences. (DTIC No. ADB 347437)

Borman, W. C., White, L. A., Pulakos, E. D., & Oppler, S. H. (1991). Models of supervisory job performance ratings. *Journal of Applied Psychology, 76* (6), 863-872.

Borman, W. C., White, L. A., & Dorsey, D. W. (1995). Effects of ratee task performance and interpersonal factors on supervisor and peer performance ratings. *Journal of Applied Psychology, 80* (1), 168-177.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155–159.

Dubois, D. A., & Shalin, V. L. (2005). Adapting cognitive methods to real-world objectives: An application to job knowledge testing. In P. D. Nichols, S. F. Chipman, & R. L. Brennan (Eds.). *Cognitively Diagnostic Assessment*.. Hillsdale, NJ: Erlbaum

Goska, R. E., & Ackerman, P. L. (1996). An aptitude-treatment interaction approach to transfer within training. *Journal of Educational Psychology, 88* (2), 249-259.

Gottfredson, L. S. (1998). The general intelligence factor. *Scientific American Presents, 9* (4), 24-29.

Jensen, A. R. (1998). *The g factor: The science of mental ability*. Westport, CT: Praeger.

Kalyuga, S., Ayres, P., Chandler, P., & Sweller, J. (2003). The expertise reversal effect. *Educational Psychologist, 38* (1), 23-31.

Kalyuga, S., & Sweller, J. (2004). Measuring knowledge to optimize cognitive load factors during instruction. *Journal of Educational Psychology, 96* (3), 558-568.

McNamara, D. S., Kintsch, E., Songer, N. B., & Kintsch, W. (1996). Are good texts always better? Interactions of text coherence, background knowledge, and levels of understanding in learning from text. *Cognition and Instruction, 14* (1), 1-43.

Palumbo, M. V., Miller, C. E., Shalin, V. J., & Steel-Johnson, D. (2005). The impact of job knowledge in the cognitive ability-performance relationship. *Applied H.R. M. Research, 10* (1), 13-20.

Pashler, H., McDaniel, M., Doug, R., & Bjork, R. (2009). Learning styles: Concepts and evidence. *Psychological Science in the Public Interest, 9* (3), 105-119.

Schaefer, P. S., Bencaz, N., Bush, M., & Price, D. (2010). *Assessing Soldier individual*

differences to enable tailored training. (Research Report 1923). Arlington, VA: U. S. Army Research Institute for the Behavioral and Social Sciences. (DTIC # ADA519594.)

Schaefer, P. S., Blankenbeckler, P. N., & Lipinski, J. (2011). *Measuring officer knowledge and experience to enable tailored training.* (Research Report 1953). Arlington, VA: U. S. Army Research Institute for the Behavioral and Social Sciences.

Schmidt, F. L., & Hunter, J. E. (1993). Tacit knowledge, practical intelligence, general mental ability, and job knowledge. *Current Directions InPsychological Science, 2* (1), 8-9.

Schmidt, F. L., Hunter, J. E., & Outerbridge, A. N. (1986). Impact of job experience and ability on job knowledge, work sample performance, and supervisory ratings of job performance. *Journal of Applied Psychology, 71* (3), 432-439.

Snow, R. E. (1991). Aptitude-treatment interaction as a framework for research on individual differences in psychotherapy. *Journal of Counseling & Clinical Psychology, 59* (2), 205-216.

Snow, R. E. (1992). Aptitude theory: yesterday, today, and tomorrow. *Educational Psychologist, 27* (1), 5-32.

Thorndike, R. L. (1985). The central role of general ability in prediction. *Multivariate Behavioral research, 20*, 241-254.

Appendix A

Course Selection Criteria

1. Number of students in each course – Each student arrives at a course with his/her own KSE (knowledge, skills experiences), gained over years. Therefore, theoretically, the larger the number of students in a course, the greater the "potential" for differences in KSE. However, keep in mind that even though there might be a large number of students, it's possible that a majority will have similar KSE, with only some minority having different KSE. Ensure that selected courses have a large enough "sample size" of students with differing KSE.

Guideline: Courses with a larger number of students are more likely to have more differences in KSE.

2. Multiple MOSs – Each MOS (and branch/specialty for officers) of the Army has some unique training requirements, skills and tasks. Therefore, personnel from varied MOSs (branches/specialties) will arrive at a course with differing KSE. However, keep in mind that even though there might be a large number MOSs (branches/specialties), it's possible that a majority of students will have a common MOS (branch/specialty), with only some minority being a different MOS (branch/specialty). Ensure that selected courses have a large enough "sample size" of students with different MOS (branch/specialty).

Guideline: The larger the variety of MOSs (and branch/specialty for officers) attending the course, the greater the likelihood of differences in KSE. Also consider that some MOSs (branch/specialties) are so different that those attending a course will increase the likelihood of different KSE. (Example: Soldiers from infantry, armor and even engineer areas are much more similar in many aspects of KSE than Soldiers from chaplain assistant or transportation areas.) An ideal situation would be a course with 2-3 well-represented, qualitatively different MOSs.

3. Course Length (topic/subject) – With the exception of Initial Entry Training (IET) courses, longer courses (more than 45 days) are generally for NCO and officer professional development and are not usually focused on a specific skill or capability. As the level of the course increases (e.g. from ALC [E-6] to SLC [E-7] or from Officer Basic Courses [O-1] to Captains' Career Courses [O-3]) the military KSE will likely increase. Personnel attending the higher level courses will have had more time in Service and more assignments. However, the overall general, military experience will become more common as the time in Service increases. Keep in mind that the focus is on the technical skill areas (not soft skills) which will only be a portion of the course.

Guideline: Generally, the shorter courses that are not designed for a specific MOS/branch are more likely to have differences in more general KSE, while the longer professional development courses will have greater differences in specific military assignment KSE areas. Consider only technical portions of professional development courses.

4. Course Content - The nature of the course content ("soft skills" versus technical skills) will have implications for how easily prior knowledge can be measured or how easily performance can be measured. Generally, need to consider the technical task areas for courses where prior knowledge can be measured and avoid attempts to measure "soft skill" areas. Consider blocks of training within courses rather than an entire course, especially if the block of training is a critical technical skill area. Also, students are more likely to possess differences in KSE in the more technical areas than in the "soft skill" areas.

Guideline: Differences in KSE will generally be more important in courses and blocks of training with structured, sequential technical skill areas that are critical for course completion. Unstructured and non-sequential courses and blocks of training will generally involve more "soft skill" areas and the differences in KSE will have less impact.

5. Prerequisites - Students attending higher level courses (e.g., Sergeant Major Academy as opposed to SLC or ALC) will generally begin the course with a more common skill level in the area to be trained in the course. If course prerequisites are established and enforced, the likelihood of prior KSE that could impact the course training may be minimal.

Guideline: "Basic" and "intermediate" level courses are more likely than more "advanced" level courses to have students with differences in KSE that matter.

6. Mandatory course completion – Courses that must be successfully completed to continue Service within the military (e.g., professional development courses versus basic digital skills) are more likely to have students attending with greater differences in KSE. The intent of the courses is generally to allow students to "cross-level" the military experiences they have gained so all can move forward with a more common and complete understanding of the military.

Guideline: Mandatory professional development courses are more likely to have measurable differences in KSE than more general subject area courses. Consider only technical portions of professional development courses, not the general "soft skills".

7. Volunteer or selected for course – Generally, courses with attendees who must volunteer (e.g., Airborne) are generally people who perceive a beneficial outcome from the completion of the course, either personal gratitude or professional enhancement. Personnel who are selected for course attendance based on some criteria (e.g., Drill Sergeant) may not have the same perceptions or motivation. Selection criteria will usually consider identifiable areas of KSE. Therefore, it could be presumed that courses with all volunteers are more likely to have a greater difference in KSE than courses with central selection processes.

Guideline: Courses that have both volunteers and selectees have a high possibility of extreme differences of KSE, as well as all volunteer courses.

Other Considerations

1. Number of courses that can be affected – Once potential courses for differences in KSE have been identified, one of the down-select factors should consider the number of similar courses taught at multiple locations who could benefit from the results of this investigation; to provide the Army a "bigger bang for the buck."

2. Decisions as to which courses to examine for this project can be based on the established criteria. In this decision process, interactions between/among criteria should also be considered as an important factor. Since only 5 courses will be selected to visit to gather information on potential KSE to measure, a further consideration is the number of potential courses at an installation that offer potential. That is, if multiple courses offer the same potential for measuring KSE, priority should be given to multiple courses at the same installation in order to maximize benefit of travel.

At the end of this criteria definition process, we will compile the assessment for each criterion for 10 courses (some information will come from web sites and other from telephone calls). When pertinent information is available we will establish a relatively simple check list to apply to the courses (see below). Keep in mind, our purpose in this exercise is to identify the 5 courses we would like to visit to help determine which KSE and what measures would be most appropriate. Something like the following rating scale might work.

Use a rating scale:

0 3 5
(Very slim chance of differing KSE) (Almost certain of differing KSE)

	Selection Criteria						
Course	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Appendix B

Small Group Instructor Predictions

The purpose of this form is to gain insight to your intuition and observations in assessing student knowledge, skills, and experiences. Many trainers have indicated that they are able to assess student potential and performance in general and/or for specific subjects and skills early in the course. Please rate the students in your instructional group and any other students in the course that your intuition, observations, or impressions have caused you to assess. Place an **X** or ✓ in the appropriate box for Land Navigation and TLP/Tactical Operations.

Student Roster Number		**Assessment of the Students Future Academic Performance**							
		Land Navigation				**TLP**			
		Top 25%	**Middle 50%**	**Lower 25%**	**Cannot Evaluate**	**Top 25%**	**Middle 50%**	**Lower 25%**	**Cannot Evaluate**
Students in My Group									
Other Students in the Course									

Appendix C

Demographic Questionnaire and Experience Scales

I. BIOGRAPHICAL INFORMATION

1. Roster Number	

2. Rank (circle one)
SGT SGT(P) SSG SSG (P) SFC Other:

TIG/TIS	Years	Months
3. Time in Grade		
4. Time in Service		

5. Primary MOS (circle one)	11B 11C	
5. A. Do you have prior experience in another Service and/or MOS?	YES NO (If YES, see 5.B)	
5.B. Other MOS & Service:	MOS:	Service/Branch:

6. Service Status (circle one)
Active Duty National Guard Army Reserve

7. Year completed WLC or PNCOC:

8. Civilian Education Level (circle highest level of education)
Non HSG GED HS Diploma Some College (no degree) Associates Degree Bachelors Degree Graduate Work Master's Degree
8. A. If undergraduate or graduate degree state type:

9. Deployment History (Most recent first)					
Return Year	Iraq	Afghan	Other	Duty Position	Unit Primary Mission
e.g. 2007	***X***			***Fire Team Leader***	***Route Security***

(Continue if more deployment experience)

10. Experience with digital C3I systems – Navigation Support	
10.A. Have you used global positioning systems (GPS) or other navigation aids to include FBCB2, LandWarrior, etc.?	Circle one: YES NO
10.B. If **YES**, did you also have available and use paper maps and a lensatic compass to assist , follow movements, etc.?	Circle one: YES NO
10.C. If **YES**, were maps and a lensatic compass your primary navigation aids?	Circle one: YES NO My duties did not require navigation.

11. Experience with digital C3I systems – Operations and Situational Awareness Support	
Have you used FBCB2, LandWarrior, or another digital command and control or situational awareness support system?	Circle one: YES NO

PART II. SKILLS ASSESSMENT

This section will ask you to self-assess selected skills.

A. There are a number of specific skills that impact your ability to navigate using a map and compass. Consider deployments, training, and periods in your career when you have been required to use your navigation skills the most. Use the scale provided to rate your frequency of use for the tasks indicated. Place check marks in the appropriate cell for each task or skill.

Task or Skill		Frequency of Use Scale				
		Never	Rarely	Monthly	Weekly	Daily
12. Measure distance travelled accurately using pace count and dead reckoning techniques.		9.5%	62.2%	18.9%	2.7%	6.8%
13. Recognizing and associate terrain features on the map and on the ground around you.		4.0%	32.4%	27.0%	10.8%	25.7%
14. Use terrain association and/or azimuths to known points to determine your location.		5.4%	49.0%	20.3%	8.1%	17.6%
15. Given a grid coordinate, finding a point or a natural or man-made feature on a map.		2.7%	31.1%	22.9%	18.9%	24.3%
16. Given a point or feature on a map and a protractor with grid scale, determine the grid coordinate to the nearest:	± 100 m	9.5%	43.2%	20.2%	9.5%	16.2%
	± 10 m	9.5%	40.5%	24.3%	10.8%	13.5%
	± 1 m	21.6%	54.0%	13.5%	4.1%	5.4%
17. Measure distance between two points on a map.		2.7%	29.7%	31.1%	20.3%	16.2%
18. Convert magnetic azimuths to grid azimuths and grid azimuths to magnetic azimuths.		9.5%	54.1%	22.9%	81.1%	5.4%
19. Navigate around obstacles or dangers, while maintaining location awareness and recover to your intended route.		4.1%	33.8%	29.7%	13.5%	18.9%
20. Given a start and end point on a map and an enemy situation, identify the best route.		6.8%	31.1%	17.6%	20.3%	24.3%

21. Your new platoon leader is planning his first mission, a dismounted movement to contact in hilly, forested terrain, similar to Fort Benning, GA. He asks for your assistance. He needs someone skilled with a map and compass; the platoon's global positioning systems are not operational. Which statement below best describes your land navigation skills.					
1.Most NCOs in the platoon can navigate better than I can.	2.I am capable of moving on a designated azimuth within ± 3 degrees for 200 meters or farther.	3.I am capable of moving on a designated azimuth within ± 3 degrees for 2 kilometers or farther.	4.I am capable of guiding my unit to within ± 100 meters of designated check points or grid locations.	5.Capable of guiding my unit to within 10 meters of designated check points.	6.Confident to call for and adjust "danger close" indirect fires.
	2.7%	6.8%	41.9%	37.8%	10.8%

22. Your company is conducting a cordon and search mission. The objective is a small village, a settlement of 30 masonry and mud dwellings in a deep river valley. The valley floor is 800 to 1000 meters across divided by the Black River, with widely separated foot fords. Vegetation in the valley floor is chest-high prairie grasses and thick groves of cedar trees, dotted with farm plots 100 X 100 meters. Your platoon's mission is the cordon. Based on <u>your navigation skills alone</u>, which mission are you best suited to lead? Circle one response.				
1.Drop off the rear of the convoy going in and establish a TCP on the main road.	2. Move beyond the village and interdict foot traffic using the shallow ford across the Black River.	3.Move to observation point on Hill 763, be prepared to move to interdict traffic along the trail networks at the base of the Hill.	4.Move by a cross country route to a specified choke point on the foot path out of the mountains. Establish a TCP to control dismounted movement.	5.Act as the company quick reaction force. Be prepared to quickly move to any point to reinforce another element or assume a mission.
2.7%	8.1%	25.7%	36.5%	27.0%

B. There are a number of specific skills that impact your ability to conduct Troop Leading Procedure (TLP), receive, understand, and issue operations orders. Use the scale provided to rate your frequency of use for each task indicated. Consider your frequency of use during a recent deployments or a period of intense training. Place check marks in the appropriate cell for each task or skill.

Task or Skill	Frequency of Use Scale				
	Never	Rarely	Monthly	Weekly	Daily
23. Analyze specified and implied tasks assigned in the platoon order to determine the tasks and purposes for fire teams.	2.7%	16.2%	21.6%	29.7%	29.7%
24. Analyze terrain to determine routes, position elements, or site weapons.	1.4%	14.9%	22.9%	17.6%	43.2%
25. Recommend or refine targets to support the scheme of maneuver or defensive positions.	9.5%	25.7%	22.9%	20.2%	21.6%
26. Issue a complete order to my subordinates and assure their understanding.	8.1%	18.9%	18.9%	21.6%	32.4%
27. Conduct pre-combat inspections of my unit with a focus on the special needs of the mission or the execution of key assigned tasks.	0%	4.1%	13.5%	14.9%	67.6%
28. Rehearse the mission or critical tasks of the mission to prepare my unit.	2.7%	4.1%	17.6%	33.8%	41.9%
29. Used a sand table, table top, mission walk through, or a part or full force rehearsal to prepare for a mission.	2.7%	17.6%	20.3%	25.7%	33.8%

30. Indicate the experience you have had with TLP, specifically receiving orders from your platoon leader or company commander.				
1.I seldom received an order. The normal process in the unit was to move out and FRAGO as the situation evolved.	2.I sometimes received an abbreviated order providing a mission statement with an overview of critical aspects of the mission.	3. I sometimes received an abbreviated order providing a mission statement with task and purpose statements for subordinate units.	4.I almost always received an order with the mission, details about the enemy situation, and specifics of the task and purpose for my unit.	5.I always received complete orders. Situation, mission, subunit tasks, and admin/log details were provided.
4.1%	9.5%	22.9%	36.5%	25.7%

31. Indicate the experience you have had with TLP, specifically receiving operations graphics and graphic enemy situation updates from your platoon and/or company headquarters.				
1.I was never provided operations graphics, mission graphics, or friendly or enemy situation updates.	2.I have seldom received operations graphics or graphical friendly or enemy situation updates.	3. I sometimes received operations graphics for the mission and graphical enemy and friendly situation updates.	4.I normally received operations graphics for the mission and graphical enemy and friendly situation updates.	5.I always received orders. They were complete with graphics and issued with sufficient time for subordinate units to conduct TLP.
4.1%	5.4%	17.6%	47.3%	25.7%

32. Indicate the experience you have had with TLP, specifically in preparing your unit for the mission with pre-combat inspections, rehearsals, and training.				
1.I never had time to prepare for the next mission.	2.Any mission preparation was done by the SOP. I never had mission details for preparation.	3. Seldom did we have mission details. Most mission preparations were based on our SOP.	4.Frequently we were able to use a table top rehearsal or sand table prepare for the mission. Pre-combat inspections were always based on mission specifics.	5.Often we did full scale rehearsals involving all Soldiers. We sometimes retrained/practiced skills (room clearing, danger areas, etc.). PCIs were mission focused.
	1.4%	22.9%	45.9%	29.7%

Appendix D

Land Navigation Prior Knowledge Test

1. Military standard topographic maps use colors and symbols to depict features and conditions. Select the item below which accurately reflects the method that would be used to depict a spot elevation. (Circle one.)

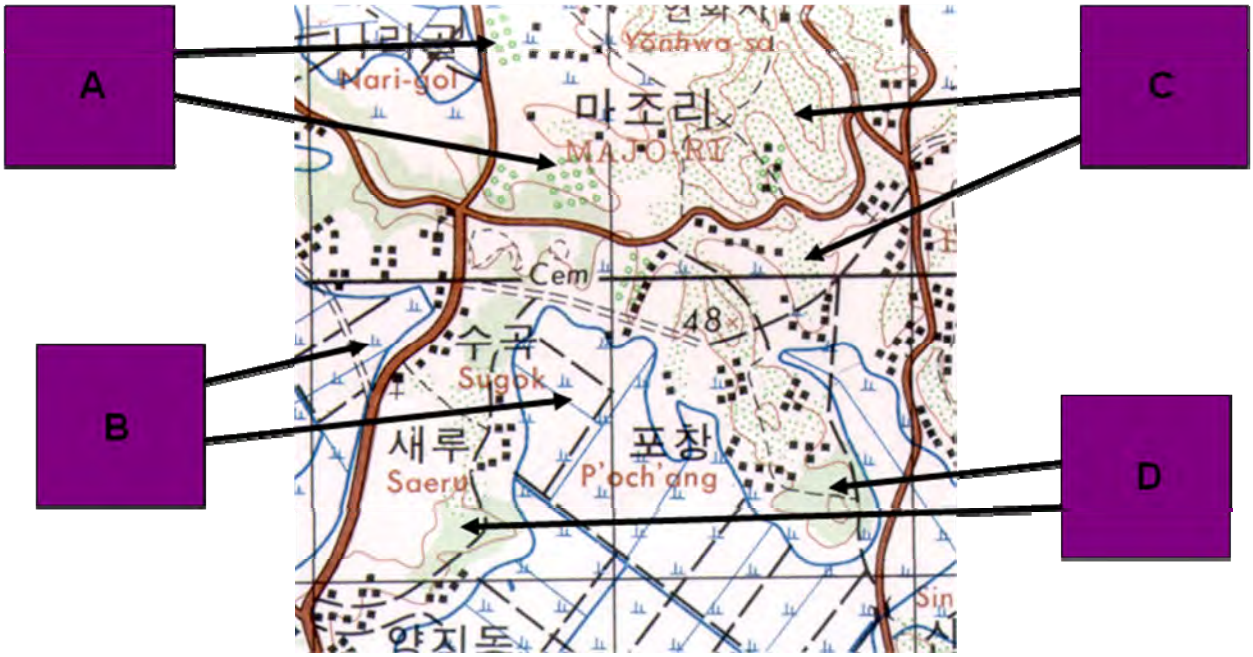
[Question 1 = 64.2% correct]

A B C D

2. Military topographic maps use colors and symbols to depict various types of ground cover, forest types, and cultivation. Match the symbol with the type of plant life or vegetation that it depicts. Enter the letter for the symbol in the appropriate blank. (NOTE: Not all letters may match descriptions; if no match is found place an "**X**" in the answer space.)

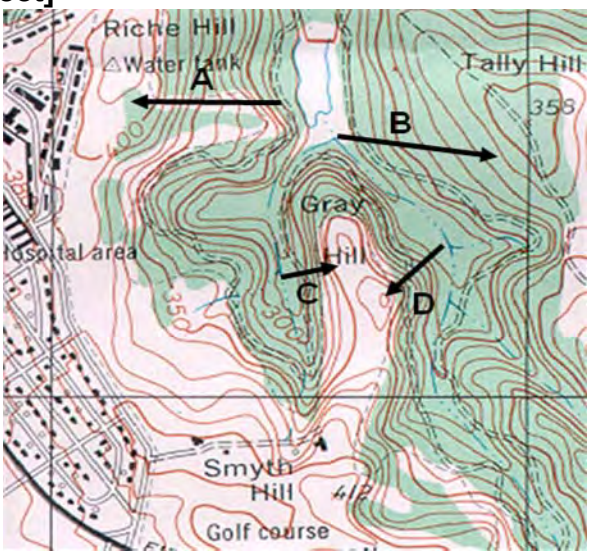
[Question 2-a = 44.8%, Q2-b = 68.7%, Q2-c = 53.7%, Q2-d = 7.5% correct]

___ Brush and scrub_ _ Orchards _ _ Rice paddies _ _ Open fields



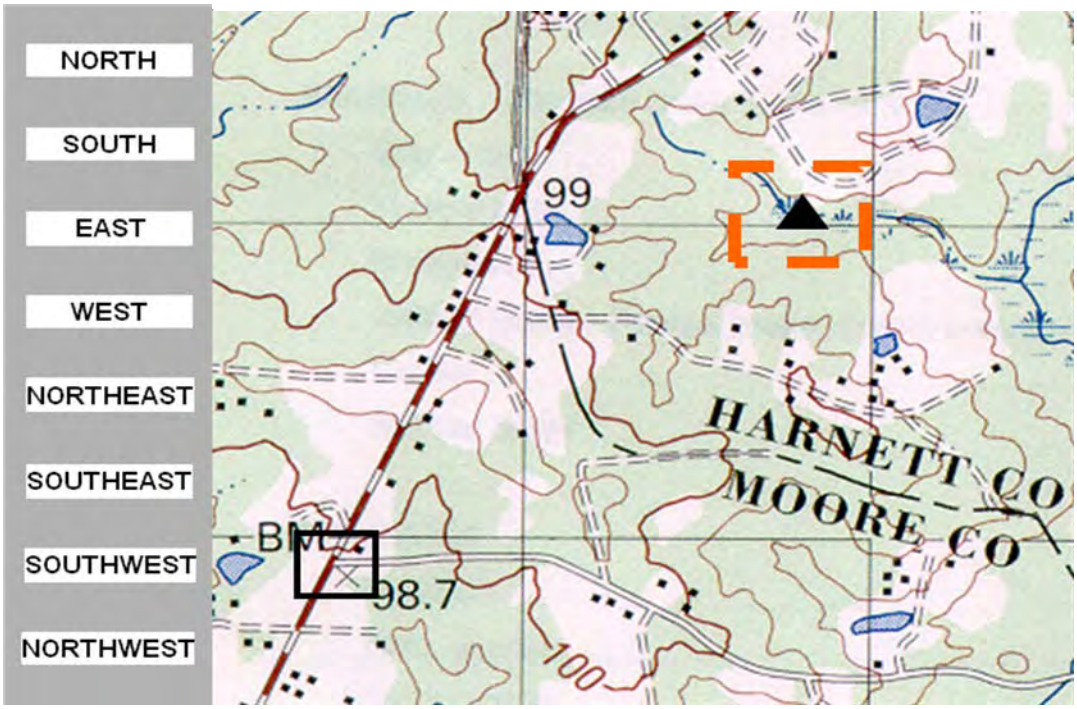
3. The contour interval of 10 feet is identified in the legend of for this map. Which labeled arrow contains the steepest climb? (Circle the best answer.)

[Question 3 = 65.7% correct]



4. From your location at the center of the triangle in the dashed orange box, what is the direction of movement to the road junction in the black box? (Circle the correct answer.)

[Question 4 = 83.6% correct]



5. You remain at the same location as in the previous question. What is the approximate grid azimuth to the road junction in the black box? (Circle the correct answer.)

[Question 5 = 76.1% correct]

315° 225° 25° 157° 190° 362° 265°

6. You have picked one of your injured Soldiers. He has been released from the hospital and returned to duty. You are being flown back to an LZ near your unit's current location. A message from your platoon sergeant provided a link up grid location of 52S BG 9965 5998. Before departing the hospital you need to draw a set of maps of your area of operations. What element of location information is provided by the letters "BG"? (Circle the best answer.)

[Question 6 = 7.5% correct]

A. Grid zone designation

B. Map sheet number

C. Grid coordinates

D. 100,000 meter grid square identification

E. None of the above is correct.

7. Your mounted patrol is moving to the Southeast; your lead element is located at 16S FA 99342 90612. Reports from a supporting UAV element indicate that enemy infantry are in the clearing at 16S GA 00202 90375. Approximately (within ± 10 meters) how far is your patrol from the hostile force? (Circle the correct answer.)

[Question 7 = 23.9% correct]

A. 1,000 meters

B. 900 meters

C. 800 meters

D. 750 meters

E. 700 meters

F. None of the previous answers are correct.

8. Your unit will be conducting "knock and search" missions in a neighborhood of a major city. The planned area of operations measures approximately 6 city blocks by 8 city blocks (1.2 kilometers X 1.6 kilometers). The Platoon Sergeant indicates that new maps are available in varied scales. Which scale of map would provide the greatest terrain details for planning and battle tracking? (Circle the correct answer.)

[Question 8 = 35.8% correct]

A. 1:250,000

B. 1:100,000

C. 1:50,000

D. 1:25,000

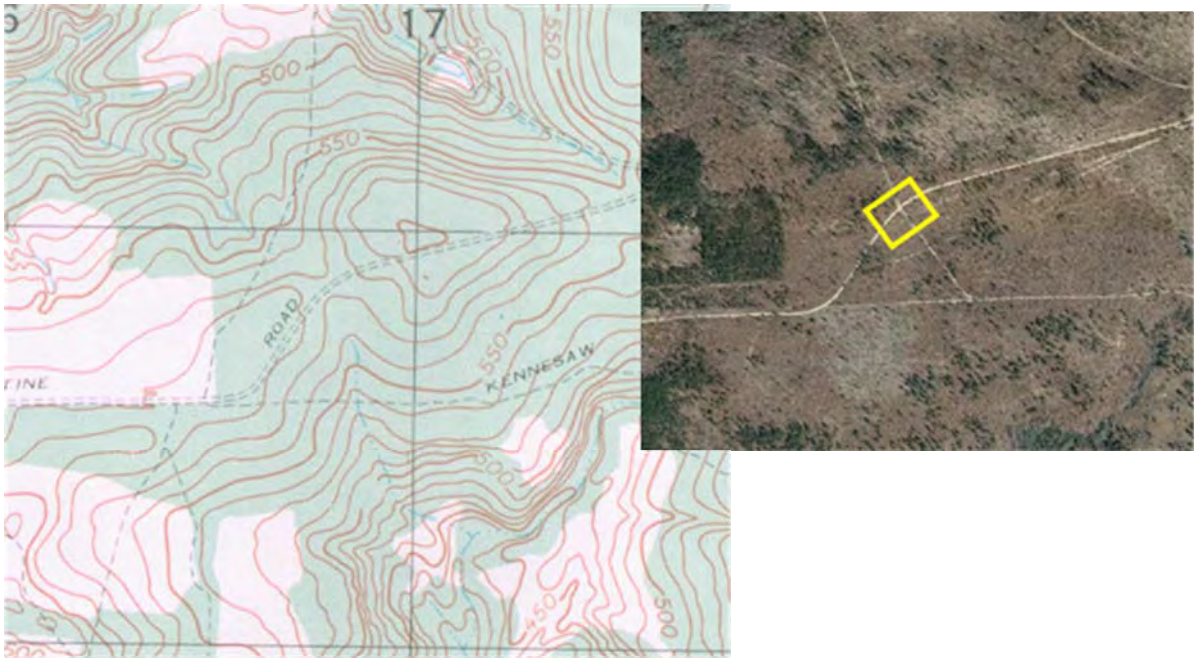
E. 1:12,500

9. Maps can be supplemented by overhead imagery to identify changes to both manmade and natural features. Current photos help determine when new roads or structures have been added, unused trails disappear, and patterns of vegetation change. Generally, major terrain features change little over time. Identify the major terrain feature, highlighted on the overhead image, on which the road junction is located. (Circle the correct answer.)

[Question 9 = 41.8% correct]

MAP VIEW

OVERHEAD IMAGE VIEW



A. Hill

B. Ridge

C. Saddle

D. Valley

E. Depression

10. The current rules of engagement require that targets engaged with indirect fires must be observed targets, more than 250 meters away from the civilian population or inhabited structures, and **located to within ± 10 meters**. The 3rd Squad is in contact but unable to communicate with the platoon leader. They are pinned down by RPG and machine gun fire coming from a cluster of trees on a hill side, well outside (± 800m) the nearest village. You alert the platoon leader and inform him that you will relay their Call for Fire. As you relay the target, which grid location provides the minimum information required for target approval?(Circle the correct answer.)

[Question 10 = 56.7% correct]

A. 16S GA 04 85

B. 16S GA 046 854

C. 16S GA 0468 8542

D. 16S GA 04688 85422

E. N 32^{o} 23' W 084^{o} 49'

11. You are training your Soldiers to navigate with a map and compass across broken terrain. You want them to be aware of some inaccuracies with their navigation techniques. For example, you're Alpha Team Leader can follow an azimuth to an accuracy of ± 3^{o} when traveling a distance of 1000 meters or less. If he departs from a known point and navigates toward a known point 1000 meters away, how close should he be to his desired destination point on arrival? (Circle the best answer.)

[Question 11 = 11.9% correct]

A. Within 150 meters

B. Within 110 meters

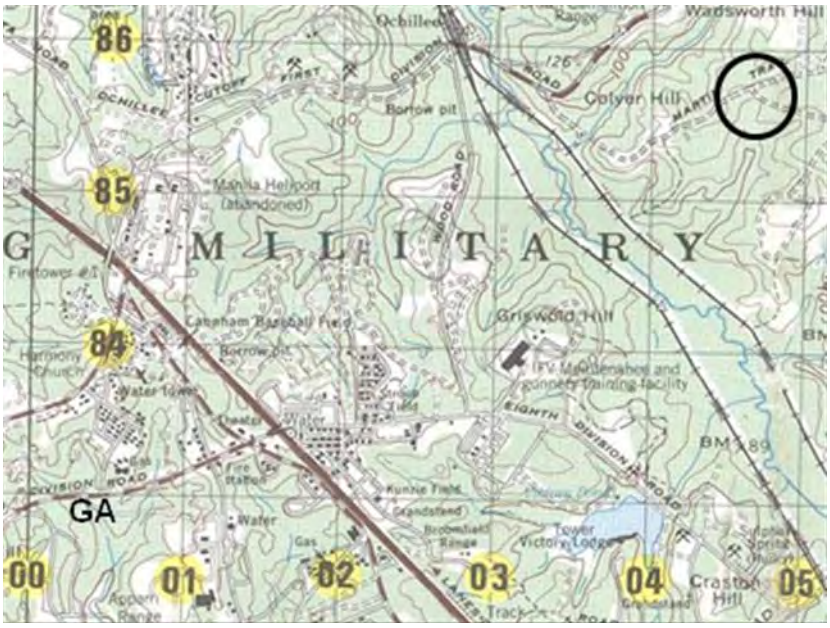
C. Within 55 meters

D. Within 35 meters

E. Within 20 meters

12. Which grid coordinate correctly locates the trail intersection in the circle to within 10 meters? (Circle one answer.)

[Question 12 = 89.6% correct]



A. 16S GA 857 046

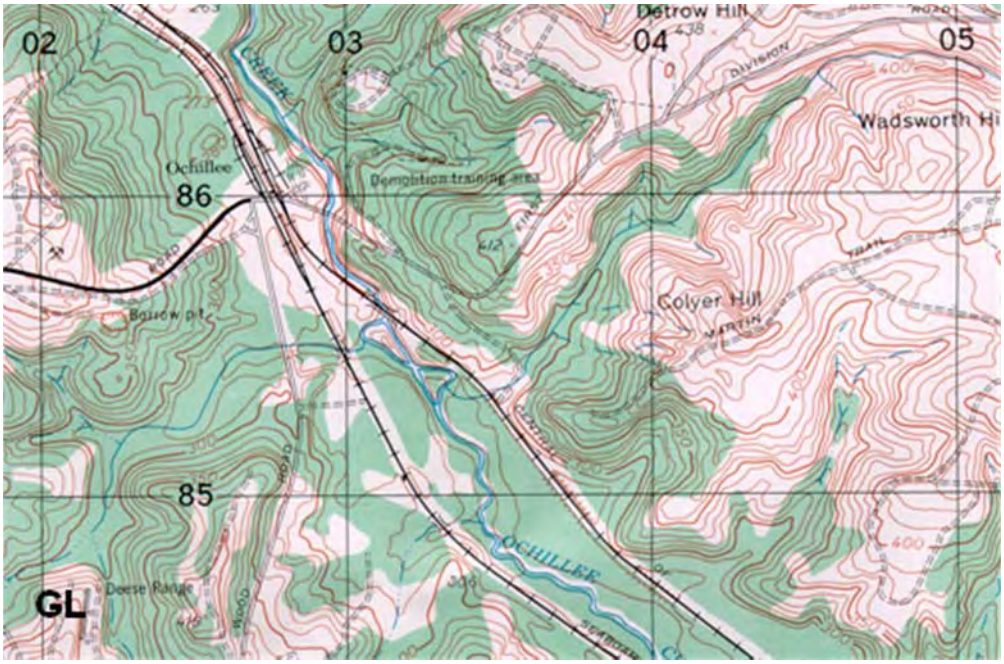
B. 16S GA 046 857

C. 16S GA 8575 0465

D. 16S GA 0465 8575

13. What feature is located at grid **16S GL 0226 8538**? (Circle the answer.)

[Question 13 = 73.1% correct]



A. Mine

B. Borrow pit

C. Hill top

D. Road intersection

E. Railroad siding

F. Railroad overpass

14. It is summer time, your current location is indicated by the point marked “P” in the map and photo below. Which photograph depicts your view from that location looking to the South? (Circle the best answer.)

[Question 14 = 71.6% correct]

A

B

C

15. Your squad is the lead element in your company's air assault mission. While your helicopter was to approach the LZ from the West, ground fires and sightings of an enemy mounted patrol caused the aircraft to take evasive action. After landing you need to quickly but accurately orient your map and prepare for the arrival of the main body in the next assault wave. Which method indicated below **IS NOT** a correct method of map orientation with a compass? (Circle the answer that best identifies the incorrect method or methods of map orientation.)

[Question 15 = 14.9% correct]

A. Place the map on a flat level surface, align the left (straight) edge of the compass with left or right printed edge of the map. Turn the map till the magnetic North of the compass is pointing to the top of the map and aligns with or is parallel to the straight edge of the compass.

B. Place the map on a flat level surface, then align the north indicating line on the map (in the margin data) with the magnetic North of the compass.

C. Place the map on a flat level surface. Find the magnetic declination data in the map margin. Place the compass on the map with the left (straight) edge along a North-South Meridian (longitudinal line). Turn the map and compass together until the **N** arrow on the compass is offset to the degree angle specified by the declination data.

D. If your location is known, select a prominent terrain feature visible from your location. Sight an azimuth from your position to the terrain feature. Position the open compass so that the left (straight) edge is on or parallel to a line from your position to the terrain feature. Turn the map and compass together until the sight azimuth is aligned on the compass.

E. None of the above techniques are correct for orienting a map with a compass.

16. While moving in the desert you cross a railroad track, to determine your location you: (Select the best answer.)

[Question 16 = 67.2% correct]

A. Sight an azimuth to a prominent terrain feature and determine where it intersects along the railroad.

B. Sight an azimuth to two prominent terrain features and determine the point of intersection on the map.

C. Both A and B are correct.

D. Neither A or B is correct.

17. When navigating at night with a lensatic compass, which technique would **NOT** be a navigation technique to consider? (Circle the answer that best identifies the incorrect method or methods for night navigation.)

[Question 17 = 44.8% correct]

A. Sight the desired azimuth and select a far away object or steering point with a distinct silhouette against the sky to travel toward.

B. In dense terrain, select steering marks that are closer together but have a distinct silhouette or a unique appearance to travel toward.

C. When steering marks are not visible, hold the fully open compass with the desired travel azimuth in front of your chest, and periodically check your azimuth as you travel.

D. Walk while continually observing the compass dial and azimuth and avoid taking sightings as you travel.

E. None of these techniques are recommended for night navigation.

18. Your squad is leading a night tactical movement of your platoon. The platoon leader approved your route around a village to avoid observation. Traveling on an azimuth of 76^{o} you arrived at Waypoint 4 (18S WK 3764 2754). You must now turn to an azimuth of 346^{o} toward Waypoint 5 (18S WK 3732 2887). You had indexed the bezel ring of your lensatic compass to allow travel along the 76^{o} azimuth. What direction and how many clicks should you rotate the bezel to align the compass to 346^{o}? (Circle the correct answer.)

[Question 18 = 3% correct]

A. 23 clicks counter-clockwise

B. 30 clicks counter-clockwise

C. 90 clicks counter-clockwise

D. 90 clicks clockwise

E. 30 clicks clockwise

F. 23 clicks clockwise

G. None of the above is correct.

NOTE: Questions 19 and 20 are to be answered without access to a map.

19. Your unit has the mission to link up with a friendly militiaman. He will guide you to an insurgent cache of weapons, ammunition, and bomb making materials. The starting location for your patrol is the road intersection at grid 52S CG 0450 8701. The link up point is for the friendly militiaman is 52S CG 0751 8402. SGT Smith, leader of your Alpha Fire Team, will be responsible for navigation for this mission. During PCIs, you want to check his plan. What should SGT Smith's approximate grid azimuth and movement distance calculations be for the most direct route to the link up point? (Circle one answer.)

[Question 19 = 19.4% correct]

A. 160^{o} for 3750 meters

B. 235^{o} for 3750 meters

C. 160^{o} for 4250 meters

D. 135^{o} for 4250 meters

E. 135^{o} for 3750 meters

G. None of the above is correct.

20. Your platoon is occupying a patrol base at 16S GA 063848 in a dense swampy area, preparing for reconnaissance missions. Your security responsibilities for the patrol base include manning an OP/LP located at 16S GA 06495 84842. Suddenly you hear trucks and tracked vehicle movement and your OP/LP calls with a report. The OP reports observing dust and hearing heavy trucks and tracked vehicles approach from the Northwest and stop. They have observed dust above the trees on an azimuth of 325^{o} approximately 900 meters from the OP. What is the approximate grid for this sighting? (Circle one answer.)

[Question 20 = 14.9% correct]

A. 16S GA 077 853

B. 16S GA 059 855

C. 16S GA 072 855

D. 16S GA 054 850

E. 16S GA 057 840

F. None of the above is correct.

Appendix E

TLP Prior Knowledge Test

General Instructions: These questions will not be used for academic evaluations in ALC. They will only be used to assess your prior knowledge and skills. If you are **uncertain** of the correct answer, **leave it blank**. Record only those answers that you believe are correct.

GENERAL SITUATION: You have just received a message from your platoon leader. The company will be conducting an attack in the morning to seize the village of Dlubac and destroy or capture insurgent forces holding the village. You pass along the warning order (WARNO) to your fire team leaders and review your procedures and SOPs in preparation for developing your order and executing your assigned mission and tasks.

Section I. Troop Leading Procedures (TLP)
The steps of TLP are:

Receive the Mission
Issue a Warning Order
Make a Tentative Plan
Initiate Movement
Conduct Reconnaissance
Complete the Plan
Issue the Operations Order
Supervise and Refine

1. Which statement below best describes Troop Leading Procedures (TLP)? (Select one answer.)

[Question 1 = 89.2% correct]

A. TLP provide a set of rules and steps that are to be followed when an order is received to assure compliance with all specified and implied tasks in the order.

B. TLP provide a doctrinal set of steps and procedures to be followed by inexperienced leaders or when units do not have an SOP. TLP can be ignored by units with good SOPs or leaders with combat experience.

C. TLP provide a sequence of steps and actions that guide and assist the small unit leader in using the time and resources available to prepare and issue orders and execute tactical operations.

D. Each step of TLP should be carefully considered, while it may be omitted or eliminated, it should only be executed once in the sequence.

E. The concept of TLP is under revision and is being replaced at all echelons by the Military Decision Making Process (MDMP).

2. Rehearsals may be conducted as an aspect of the Supervise and Refine step of TLP. Rehearsals may be simple map rehearsals with leaders, sand table or terrain model rehearsals that permit participants to observe their actions and tasks in relation to others, or reduced- or full-force rehearsals to allow movements and actions under conditions similar to those expected in the AO.

[Question 2 = 91.9% correct]

Which actions listed below **CAN NOT** be accomplished by well-planned rehearsals? (Select one.)

A. Reveal weaknesses or problems in the plan.

B. Eliminate all uncertainties about how the enemy will act or react.

C. Reinforce training readiness and increase proficiency in critical tasks.

D. Review and practice contingencies and "be prepared" tasks of the mission.

E. Confirm leader and Soldier understanding of the mission and tasks to be performed.

3. TLP may be conducted in a time constrained environment. Some steps of TLP may be considered and omitted. However, other steps may recur several times during planning. Identify the step or steps that may occur several times or be continuous during TLP. (Select all that apply.)

[Question 3a = 32.4%, 3b = 17.6%, 3c = 40.5%, 3d = 74.3%, 3e = 87.8% correct]

A. Initiate movement or relocate to facilitate mission planning, preparation, or execution.

B. Issue a warning order.

C. Conduct reconnaissance

D. Supervise and refine plans

E. None of the above elements are recurring or continuous.

4. Dissemination of WARNOs can support mission planning and preparation. What are some of the ways that WARNOs can have a positive impact on TLP? (Select all that apply.)

[Question 4a = 74.3%, 4b = 56.8%, 4c = 56.8%, 4d = 81.1%, 4e = 54.1% correct]

A. Alert subordinates to a new or changing mission.

B. Provide information on the time available to prepare.

C. Provide information on the enemy, mission tasks, and guidance for preparations.

D. List all courses of action being considered.

E. Permit preparations to take place in parallel with planning.

Section II. Operations Orders.
Use the order format below to assist in answering questions 5 – 13; see the example below.

You have received an order from your platoon leader. Initially, your squad is the main effort. He asks you to inform him of the time that you will issue your oral order to your fire team leaders or the squad. The platoon leader and company commander will be present when you brief your order. Squad orders are generally direct and simple. Use the five-paragraph operations order (OPORD) format outlined below to organize the information in your orders briefing:

OPORD Reference	
Short Answer Key	**Five-paragraph Order Example**
A	1. Situation.
B	a. Enemy Forces.
C	b. Friendly Forces.
D	c. Attachments and Detachments.
E	2. Mission.
F	3. Execution.
G	a. Concept of Operations.
H	b. Maneuver.
I	c. Fires.
J	4. Service Support.
K	5. Command and Signal.
L	a. Command.
M	b. Signal.

Example question:
For the next mission, each fire team will be issued an M26 Modular Accessory Shotgun System (MASS) and 30 rounds of door breaching (frangible slugs) ammunition. Where should this information be inserted in the order?

Example Answer: __J__

Remember, you will brief your order to your squad. Use the five-paragraph format to help organize the information.

5. A machine gun team from the Platoon's Weapons Squad and an engineer demolition team will be attached for the next mission. Where in the order should this addition to your squad be indicated?

[Question 5 = 78.4% correct]

Answer: ____

6. The Platoon Sergeant will establish an initial casualty collection point (CCP) on the North side of Building H at 16S GA 0651 8363. He plans to move the CCP near the breach point after entry. Where should CCP information be indicated in your order?

[Question 6 = 45.9% correct]

Answer: ____

7. After a brief review of your Platoon Leader's order, you have developed the following statement, "3rd Squad attacks tomorrow after 0400 on signal to seize the northwest wall of Building A2 (16S GA 0653 8359) and create a breach, pass the platoon (-) and support the clearing and seizure of Building A2." Where should this statement appear in your order?

[Question 7 = 43.2% correct]

Answer: _____

8. Your Platoon (1st) will be the main effort passing through 3rd Platoon and supported by an attack by 2nd Platoon. Where should you discuss the mission and locations of the 2nd and 3rd Platoons?

[Question 8 = 47.3% correct]

Answer: ____

9. You have information on the location of two insurgent snipers and some details on the locations and dispositions of insurgent forces in the Platoon's Objective Bone (Building C4). Where should this information go in the order?

[Question 9 = 86.5% correct]

Answer: _____

10. The weather is expected to change tonight from the current mild temperatures and partly cloudy skies. Rain, low clouds, and fog are expected after midnight. In which **major paragraph** of the order is weather usually discussed?

[Question 10 = 55.4% correct]

Answer: ___

11. In which section of the order should you indicate the specific tasks to be performed by your fire teams and attached elements?

[Question 11 = 33.8% correct]

Answer: ____

12. In addition to radio communications, a green star cluster will be used to order the attack to commence. Purple smoke will be used to mark the entry hole when the breach is made. Where should this information be indicated in the order?

[Question 12 = 66.2% correct]

Answer: _____

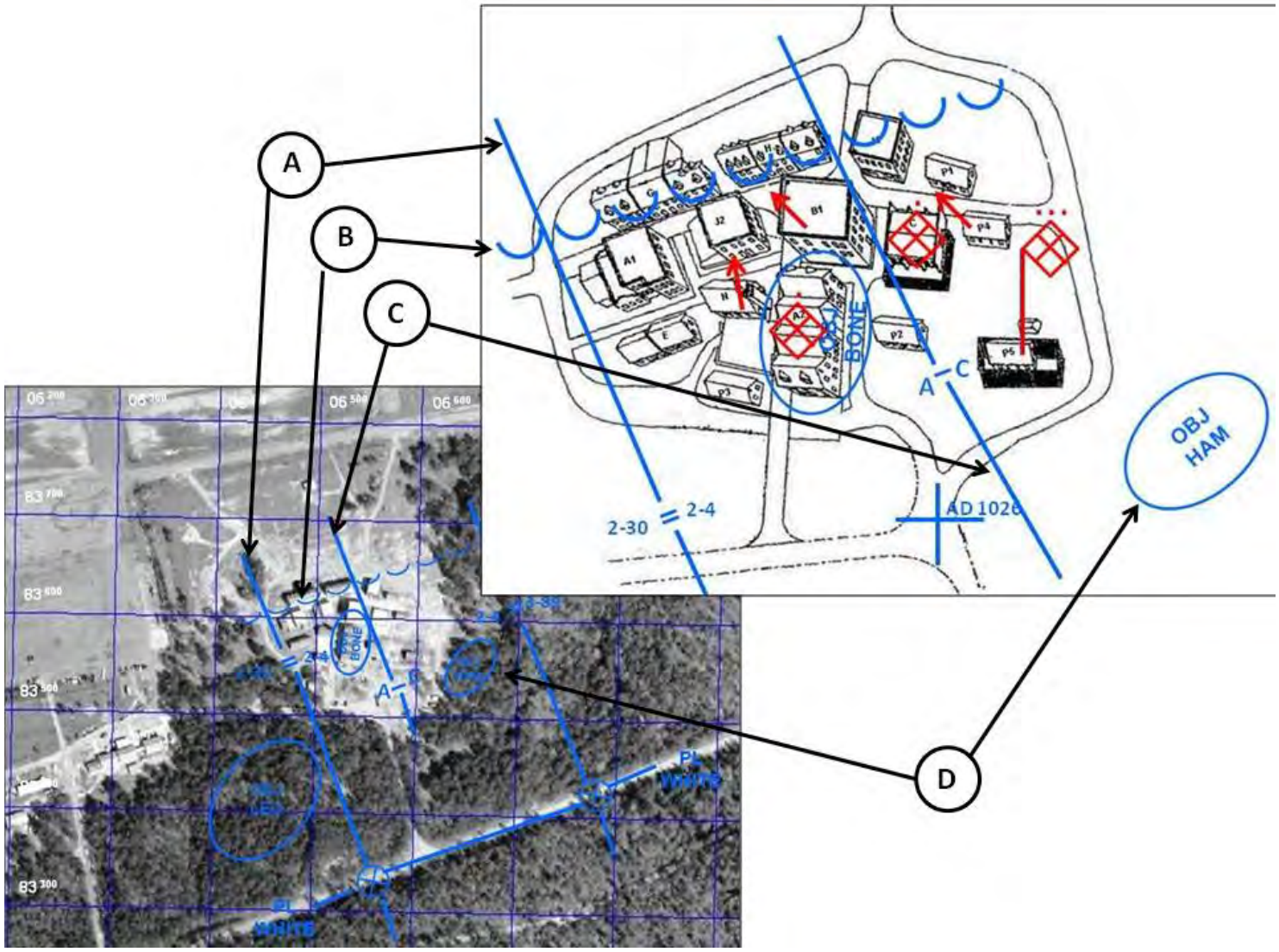
13. The platoon leader will initially move with 2nd Squad (immediately behind you) and move through the breach that you will create. What section of the order should contain information on the location of the Platoon Headquarters?

[Question 13 = 17.6% correct]

Answer: ____

Section III. Military Symbols and Graphics.

The Platoon Leader provided you this map and diagram when he issued his operations order. Use the operation's overlay on the photo map and the operation's sketch to assist in answering questions 14 – 20.



Enter the letter that points to the operations symbol. (Note: Not all symbols or letters may match.)

14. The boundary between 2nd BN 4th INF and 3rd SQDN 89th CAV ____

[Question 14 = 67.2% correct]

15. The forward line of troops or front line trace ____

[Question 15 = 68.9% correct]

16. A tactical objective in the C Company, 2nd BN 4th INF's sector _____

[Question 16 = 56.8% correct]

17. The boundary between 2nd BN 4th INF and 2nd BN 30th INF ____

[Question 17 = 79.7% correct]

18. Snipers have been detected in the village. While the enemy may move, in which buildings have snipers been confirmed? (Place a ☑ or ☒ in the box in front of the building identifier.)

[Question 18a1 = 82.4%, 18a2 = 66.2%, 18b1 = 63.5%, 18c = 63.5%, 18h = 63.5%, 18p4 = 56.8%, 18p5 = 70.3% correct]

- ☐ A1
- ☐ A2
- ☐ B1
- ☐ C
- ☐ H
- ☐ P4
- ☐ P5

19. What size and type element is being reported in your objective – Objective Bone, Building A2? (Circle the letter.)

[Question 19 = 51.4% correct]

A. Infantry Fire Team

B. Infantry Squad

C. Medical Squad

D. Engineer Squad

E. Infantry Platoon

20. As you examine the situation, you determine that you could receive effective fires from the squad sized insurgent element less than 200 meters to your East. Which unit is responsible to neutralize this threat?

[Question 20 = 45.9% correct]

A. 2nd Platoon, A, 2-4 INF

B. 3rd Platoon, C, 2-4 INF

C. C, 2-4 INF

D. C, 3-89 CAV

E. 2-30 INF

Appendix F

Descriptive Statistics

Table F-1
Prior MOS

Value	Frequency	Percent
Yes	13	17.8
No	60	82.2
Total	73	100

Table F-2
Civilian Education Level

Value	Frequency	Percent
GED	5	6.8
HS Diploma	26	35.1
Some College	36	48.6
Associates	4	5.4
Bachelors	3	4.1
Total	74	100

Note. College degrees specified were as follows (1 of each): Business, Criminal Justice, General, History, and Hotel Management.

Table F-3
General Land Navigation Experience Questions

Experience with Global Positioning Systems		
Value	Number of Soldiers	Percent Soldiers
Yes	73	98.6
No	1	1.4
Total	74	100
If GPS Experience, Also Use of Maps and Compass		
Value	Frequency	Percent
Yes	61	83.6
No	12	16.4
Total	73	100
If Use of Maps/Compass, Used as Primary Navigation Aids		
Value	Frequency	Percent
Yes	18	27.7
No	47	72.3
Total	65	100
Used FBCB2, Land Warrior, Other C2 System		
Value	Frequency	Percent
Yes	72	97.3
No	2	2.7
Total	74	100

Table F-4
Frequency Scale Summary Score Statistics

Statistic	Land Navigation Frequency Scale	TLP Frequency Scale	TLP Frequency Scale 2
Mean	31.56	26.49	11.66
SD	9.55	6.33	2.28
Minimum	11	10	6
Maximum	53	35	15

Table F-5
Land Navigation Prior Knowledge Test Item Statistics

Question Number	Mean	SD	Question Number	Mean	SD
1	.64	.48	10	.57	.50
2a	.45	.50	11	.12	.33
2b	.69	.47	12	.90	.31
2c	.54	.50	13	.73	.45
2d	.07	.26	14	.72	.45
3	.66	.48	15	.15	.36
4	.84	.37	16	.67	.47
5	.76	.43	17	.45	.50
6	.08	.26	18	.03	.17
7	.24	.43	19	.19	.40
8	.36	.48	20	.15	.36
9	.42	.50			

Note. N = 67 respondents.
Mean = Percent correct responses.

Table F-6
Land Navigation Prior Knowledge Test Summary Score Statistics

Variable	Statistic			
	Mean	SD	Min	Max
Total Points	10.40	3.04	4	18
Percent Correct	45	13.20	17	78

Table F-7
TLP Prior Knowledge Test Item Statistics

Question Number	Mean	SD	Question Number	Mean	SD
1	.81	.39	10	.55	.50
2	.92	.27	11	.34	.48
3a	.32	.47	12	.66	.48
3b	.18	.38	13	.18	.38
3c	.41	.49	14	.62	.49
3d	.74	.44	15	.69	.47
3e	.89	.31	16	.57	.50
4a	.74	.44	17	.80	.40
4b	.57	.50	18a	.86	.34
4c	.57	.50	18b	.66	.48
4d	.82	.38	18c	.64	.48
4e	.54	.50	18d	.64	.48
5	.78	.41	18e	.64	.48
6	.46	.50	18f	.57	.50
7	.43	.50	18g	.70	.46
8	.47	.50	19	.51	.50
9	.88	.33	20	.46	.50

Note. N = 74 respondents.
Mean = Percent correct responses.

Table F-8
TLP Prior Knowledge Test Summary Score Statistics

Variable	Statistic			
	Mean	SD	Min	Max
Total Points	20.62	5.72	6	32
Percent Correct	61	17	17	94

Table F-9
Land Navigation Criterion Summary Score Statistics

Variable	Statistic			
	Mean	SD	Min	Max
Total Points	5.33	1.47	0	8
Percent Correct	67	19	0	100

Note. *N*=67 respondents.

Table F-10
Land Navigation Criterion Go/No Go Status

Value	Number of Soldiers	Percent
No Go	9	13.4
Go	58	86.6
Total	67	100

Table F-11
TLP Criterion Summary Score Statistics

Variable	Statistic			
	Mean	SD	Min	Max
Total Points	24.57	3.24	15	30
Percent Correct	82	11	50	100

Note. N=72 respondents.